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The Right to Progress.

Last week's meeting of the National Association of Manufacturers in Detroit assumed a character which, a few years ago, would have seemed utterly beyond the bounds of possibility in this country. Manufacturers are not usually or generally well versed in the science of economics and are absolutely unmoved by abstract arguments. But they are thoroughly accustomed to dealing with concrete affairs affecting their business and the logic of events has brought them into a position which no amount of pure or abstract logic could possibly have induced them to assume.

A great variety of manufacturing interests were represented at Detroit and the representatives were nearly all lifelong protectionists and members of the political party which has especially stood for the protective tariff principle. Nevertheless, with practical unanimity they, one after the other, declared that, upon their own goods, they no longer needed protection and would be better off without it, declaring that its only present effect was to enhance the cost of the raw materials they must use and to thus and otherwise help their foreign competitors whom they must meet in European markets.

The only dissenting voice was from one or two members of the association who represented the knit-goods trade, one of whom by what were nothing less than brutal threats gave notice that the manufacturers of America would not be allowed to secure the removal of any of the shackles which now impede their progress in foreign trade unless, in any treaty or law that might be formulated the knit-goods manufacturers "got what they wanted"—*i. e.*, a continuance of the present high rate of duty on what are known as "shaped goods." It may be that this industry needs to have the privilege of continuing to tax practically the entire people of the United States in order to continue business, though we do not accept the statement without much better proof than was submitted; but, be this as it may, it must we think be plain that if the manufacturers of this country are ever to be given the greater freedom of international trade which the large majority of them now undoubtedly desire they must expect when specific action is to be taken, to meet with more or less opposition from those who for one reason or another, valid or otherwise, good or bad, want no change for themselves and will resist any effort to bring about a change which affects their special privileges.

The chief centers of knit-goods manufacturing are France and Germany. Neither of these countries produces cotton, and when Chemnitz knit goods are landed in America it means that American cotton has been shipped over there, made up and shipped back, which in itself is considerable protection, the cost of which must be borne by those who wear the commoner kinds of hosiery or underclothing—*i. e.*, by the masses of the American people. These countries very naturally want any modifications of tariffs that may be arranged for to apply to this, to them important article of export and in our opinion our machinery men, shoe manufacturers and others who want freer opportunities for trade abroad must be prepared, not merely to meet and pass resolutions favoring reciprocity and condemning excessive protective duties as they did last week in Detroit, but they must go further and organize some agency by which their rights to trade abroad will be presented to Congressional committees, to Congress, or, if these fail, to the people of the United States in such a manner as will insure their being heeded. Such unanimity or general consent among manufacturers as was secured in building up tariff schedules cannot be expected in reducing them and those whose business interests require modifications in the tariff must be prepared to fight for them because almost any conceivable reciprocity treaty or tariff reduction measure will be morally certain to arouse the opposition of one or more specific and perhaps specially situated industries. These must be sacrificed if need be, to the general good, simply because there is no other way and, further, because it is certainly true that unless the manufacturers themselves secure some definite modifying action, action will result through political forces that will perhaps know little and care less about manufacturing interests. Warning to that effect was openly given by a delegate at Detroit and the warning was evidently received as the counsel of a friend. The testimony and discussion at Detroit appeared to be the final and logical outcome of all the talk we Americans have indulged ourselves in about the superior efficiency of our highly paid, intelligent and ambitious workmen, our abundant supply of raw materials, general use of labor-saving machinery and direct business methods. It proved that there has been something more than talk in all this, and it would be queer if our manufacturers did not show a disposition to make full use of their opportunities and to fight if need be for freedom to advance.

Opportunity for American Machinery in Denmark.

American machinery is finding the way to Denmark in steadily increasing quantity every year, but the trade between the United States and Denmark is as yet rather small compared with the possibilities for extending the same. The nearness to Germany, England and France accounts to a great extent for the foothold the manufacturers of these nations have gained in the Danish market, but with the existing ample and direct shipping facilities and low freights there is no reason why American machinery should not be able to enter into successful competition to a greater extent than hitherto.

Denmark is a small country, but the imports are very large for its size. The domestic manufacturing has made a considerable spurt in the last ten years and the present unsatisfactory state of the labor market in the capital, Copenhagen, which is also the industrial center of the kingdom, has contributed largely to the increasing demand for machinery of which comparatively little is manufactured in Denmark, owing to the absence of coal, iron and other metals, and perhaps mostly

because the country being so small there is not a sufficiently large domestic market to encourage the establishment of large plants, and the same conditions make it impossible to seek customers in foreign markets.

The Danish customs tariff which dates from 1863 is also insufficient to protect domestic manufacture of machinery as the duty on such manufactures never exceeds 10 per cent. ad valorem.

In recent years many thousands of dollars' worth of machinery have been purchased for the Copenhagen Freeport. The orders went mostly to Germany, because there were no bids from America, and English offers were too high.

The Freeport, which was opened for traffic in 1895, is as yet not completed as far as machinery is concerned, and there will be several opportunities for American manufacturers to make bids for elevators and hoisting machinery of different kinds. The Freeport was intended principally as a distributing point for merchandise to be transshipped at Copenhagen for Swedish, Norwegian, Finnish and Russian points in competition with the Freeport at Hamburg, Germany, but at present it is used for storage of grain and corn besides for merchandise.

American machine tools are pretty well introduced by this time, but there are possibilties of considerable increase in this business, as the demand has been stimulated by the establishment of a number of factories and works using such machines. It is especially the desire of several Danish manufacturers to manufacture street cars and rolling stock for railroads in Denmark, instead of importing from Germany. A number of German manufacturers of machine tools are represented in Copenhagen and making every effort to increase their trade, while some English, French and Swedish machines are also on the market.

English gas engines and gas motors formerly had almost a monopoly with a few orders now and then going to Germany, but at the present time American gas motors have demonstrated their merit and are selling equally well as English and have a fair chance of enjoying a preference in the near future.

In steam engines and boilers there are also good prospects for increasing the exports from the United States to Denmark. Water power is exceedingly scarce, and the use of electric power is very limited as yet, being practically confined to the two street car lines operating trolley cars in Copenhagen.

The best way to try for business in Denmark is by having a reliable agent in Copenhagen. Most of the agents in this line are also dealers in machinery and supplies and well posted on the requirements of the customers.

Credits of three months are usual and can generally be granted without fear of bad accounts, as the business morals of the Danish manufacturers and dealers are uniformly good, and the bankruptcy laws are rather severe. It is, however, always advisable to ask for bank references from any of the leading banks—Landmandsbanken, Privatbanken or Handelsbanken—which all have correspondents in the United States.

The principal importers and dealers in machine tools in Copenhagen are: H. E. Bonne, Vestergade 28; Carl Dahl & Co., St. Kannikestr. 14; Wm. O. Jensen, Jernbanegade 6; H. Kirshner & Cohn, Toldbodvei 22; V. Lowener, Kvaesthusgade 6; Svend Mariboe, Cort Adelersgade 8; Nienstaedt & Co., V. Boulevard 20; Hermann Raffel, Bredgade 33; N. A. Schorring, Rewentslowsgade 10; Wilh. Sonesson & Co., Frihavnen.

There are direct steamers running from Boston, New York, Newport News, New Orleans and Galveston to Copenhagen, and the freight rate is about five dollars per ton. J. G. F.

An Altruistic Conference.

We have received the following circular letter from F. M. Savage, superintendent of the Steel Works Club, Joliet, Ill., which explains itself:

"Dear Sir—There are a number of firms and corporations interested in the social and economic advancement of their employees, and there are a number who have institutions and activities with such intent.

"There is much to be gained through an exchange of ideas and a free discussion of the work.

"Assuming the same to be true, and as no one else has taken the initiative, I send you this circular letter, asking if you will be present yourself or send a delegate, to a meeting to be held for the purposes named, and I suggest that the same be held at a central point like Buffalo, or on the Lakes, about June 17.

"Should these suggestions accord with your views, in your reply, if possible, please give the name of the delegate, the place and the time you prefer the convention shall be held."

An appendix to the letter states that "the conference is called to meet at Detroit Hotel, Buffalo, Monday, June 24, 1901."

Defiance from Toronto.

A press despatch dated Toronto, Ont., 8th, says: "The International Machinists' Association to-day adopted a resolution to the effect that, 'After due consideration, we accept the challenge of the National Metal Trades Association, and in accepting this declaration of war we cheerfully pick up the gauntlet and hurl back defiance. We never will accept any modification of our demands or resume labor until the cause for which we struggle is triumphant and a shorter workday is an accomplished fact.'"

The adoption of heroic resolutions, the throwing down of gauntlets, etc., are all right in their way, but, as we understand it, the manufacturers simply demand that the men shall stand by an agreement made with them and known as the New York agreement, and declare that so long as the machinists refuse to abide by this agreement—*i. e.*, to continue at work pending the settlement of disputed points by arbitration—they, the manufacturers, will not attempt to make any other arrangement with them whatever and this position is simply unassailable. As we have said before, agreements must be lived up to as a condition precedent to any satisfactory settlement, and the leaders of the union by refusing to submit the question of wages to arbitration, as the New York agreement provided should be done, have placed themselves and the men they represent in a false position.

So far as we remember, not a single employer has expressed himself to us as being opposed to the nine-hour day, but they are opposed to being led into the making of an agreement which at the first sign of trouble is ruthlessly broken.

Ninth Annual Meeting of the Society for the Promotion of Engineering Education.

The meeting of this society will be held in Buffalo, June 29, July 1 and 2. The program is unusually long, comprising twenty papers in addition to reports of committees, etc.

Technical Publications.

"The Induction Motor." A short treatise on its theory and design with numerous experimental data and diagrams. By B. A. Behrend. 105 6x8½-inch pages, with 56 illustrations. The "Electrical World and Engineer": New York. Price, $1.50.

No serious book on this subject can be simple or popular, and this book is no exception to the rule. The entire subject is involved in complexities, and the most that any writer can do is to clear some of them away. This the author has endeavored to do, largely through the use of graphical methods, in place of purely analytical ones.

"Electrical Designs," comprising instructions for constructing small motors, testing instruments, etc. 262 6x9-inch pages, with 289 illustrations. Reprinted from the "American Electrician." Price, $2.00.

The title of this book sufficiently describes its contents. It is the work of more than a dozen contributors to the columns of our contemporary and includes instructions for making various sizes of motors of from one-sixth to three horse-power. Numerous other types of apparatus are included, such as transformers, rheostats, voltmeters, ammeters, watt-

meters, galvanometers, storage batteries, induction coils, etc. The instructions are clear and explicit, and the book should serve an excellent purpose with those who desire to construct apparatus of this class.

"The Electro Magnet." By Townsend Wolcott, A. E. Kennelly and Richard Varley. Second edition. 134 4½x6½-inch pages, with numerous illustrations. The Varley Duplex Magnet Company, Phillipsdale, R. I. Price, $1.

This little book belongs to the best class of monographs. It does not discuss electrical machinery at all, but confines itself to an explanation of the properties of electro magnets and of the calculations necessary in the design of magnets for different purposes and conditions. It is largely from the pen of a manufacturer, and while strictly scientific in its method, it gives many facts and data which are not found in text books. It begins with first principles and concludes with a number of examples actually worked out and dimensioned engravings of nearly all sizes of telegraph and telephone magnet bobbins. Of course it is understood that in a book of this kind considerable algebra is necessary, though this is not of a character which need frighten anyone having some knowledge of formulas.

"The Principles and Practice of Linear Perspective." By Herman T. C. Kraus. Atlas form, 53 15½x11½-inch pages, with 14 full-page plates. Norman W. Henley & Co., New York. Price, $2.50.

The chief differences between this and other books on the same subject lie in the fact that its illustrations are not so exclusively from architectural sources, but include a plentiful sprinkling of mechanical subjects, and that a good deal of space is given to approximate and simple methods for obtaining what the author calls "geometric perspective," of which isometric perspective is the most used. Perspective will never be used in making drawings of machines to the extent that it is in architecture, because of the greater proportion of curved lines to be dealt with. The straight lines of buildings lend themselves much more readily to perspective treatment than do the more numerous curves of machines, and the public for whom buildings are designed have greater need of perspective drawings than have those for whom machine drawings are made. Nevertheless, we are convinced that an acquaintance with perspective, and especially with the approximate methods above referred to, would prove a very useful accomplishment to mechanical draftsmen. Even if seldom or never used in actual working drawings, it would be of great assistance in making preliminary sketches.

One blast furnace of the Edgar Thompson group at Bessemer has been in continuous blast more than seven years, and made over 1,000,000 tons of Bessemer pig.

Commercial Review.

New York, Monday, June 10.

THE SUPPLY MARKET AND GENERAL NOTES.

The extent to which the machinists' strike has affected the demand for machinists' supplies in this quarter is less than might easily have been anticipated. To judge at least from the reports of the local houses we have consulted, its results, while occasionally perceptible, are not realized as much more than a matter of curiosity. There are indications that in some districts business is less active. For instance, an emery wheel salesman has met with discouragement in a New England trip and a power-transmitting agency in western Connecticut reports unfavorable conditions.

In valves, steam fittings, etc., which are frequently handled together with machinists' supplies, there have been some sharp advances, attributed to the strike. A peculiarity about these increases is that they have been made, so far as known, without the usual preliminary tips to the jobber. When a manufacturer intends to put up rates, it is quite customary for him to give previous notice to his agents, who inform the dealers that buy of them and the latter are enabled to stock up in anticipation. This serves a twofold purpose. It keeps the customers on good terms and it enables the manufacturer to take in a large volume of orders. In the present case, it is the natural policy of manufacturers embarrassed by striking machinists to make the most money they can from their stock on hand and what they can still turn out, rather than load themselves up with contracts.

Demand for supplies is holding on well into the season, there being no premature "midsummer dullness." As nearly as can be judged, the volume of trade is equal to that of 1900 or slightly larger.

The power-transmitting machinery line is active, in some cases notably so. One company engaged in this branch, together with conveying machinery, etc., is so busy that it is looking for but few contracts outside of its general custom. Another prominent power-transmitting machinery company is reported also to be loaded up with orders. A third is decidedly busy though less so than it was earlier in the year. It regards trade as about midway in activity between that of 1899 and 1900, 1899 having been the best year of the three.

A man from a Western town affected by the strike has been looking about in New York for a shop where he can have a street-car fare register or some such specialty made by contract, expecting eventually to contract for $200,000 worth. It is believed that this signifies the diversion by the labor difficulties of business which otherwise would probably have been placed in the town referred to.

One of the most interesting announcements of the time being is that there are likely to be forthcoming deals amounting to $7,000,000 in American machinery, etc., connected with the Guayaquil & Quito Railway in South America. The Ecuadorian Association, which is building the railroad, is an English corporation, but at least half the stock is said to be held by New Yorkers. It has recently bought for the road 20 locomotives in this country, besides cars and rails, and is expected to order 25 more locomotives and 1,700 freight cars in a few days. The company is now developing sulphur mines in Ecuador and prospecting for gold, zinc and coal. It is hoped to place contracts for $2,000,000 worth of mining machinery before fall. It is proposed also to equip twenty sugar refineries along the route, which now employ antiquated French apparatus, with American machinery costing some $2,500,000, and there is under consideration a scheme for the erection of flour mills to cost between $2,000,000 and $3,000,000. The railway will open up regions which will furnish a market also for agricultural machinery. The office of the Ecuadorian Association is 33 Wall street, New York.

The Higley Machine Company, of Croton Falls, N. Y., whose incorporation is noted in another column, has been formed to take over the business of the former Higley Sawing & Drilling Machine Company. Its product will be handled exclusively by the J. R. Van Dyck Company, with New York office at 136 Liberty street, which has also lately been formed and which will handle other machinery, railroad supplies, etc., as well. The incorporators of the latter are J. R. Van Dyck, Henry B. McKee, Wm. H. Harrison, Lester B. Churchill and Boyd McLean.

In view of the usual relative success of England and America in neutral machinery markets there seems to be a good opportunity for the latter to build up a large custom in Japan. At present the United States comes second as an exporter of machinery and locomotives to Japan. Great Britain exports more than one-half of the total amount, while we are credited with a little less than one-fourth for 1899 and a little more than that proportion for 1900. The total Japanese imports of this class in 1900 amounted to $5,674,546, about one-fifth of which represented locomotives.

GERMAN MACHINERY TRADE CONDITIONS.

A resumé of the market for various sorts of machinery from the view point of Leipzig-Plagwitz, appears in our contemporary, the "Metall-Industrie Zeitung," of Remsheid. As it seems to reflect German conditions in general, and to some extent those in other parts of the world, the following translation may be useful to American exporters:

"The state of the machinery industry up to date is unchanged. It is of about the same weight as at the beginning of the year and has with few exceptions suffered

under the general unfavorable conditions. This is decidedly true of machine tools. In this line the work of most shops is quiet and contracted in volume so that for some time past a diminished number of workmen have been employed. The orders that come here and there are small, quickly executed and insufficient to justify hope for an early betterment of trade. It is the same way with woodworking machinery, which line has lately met with a fresh crisis, from which, however, it need not be supposed that the conditions are likely to lead to improvement. Such hopes have soon been dispelled. In this case, as in that of the machine-tool manufactories, the solid profits from a few orders that came in seemed to promise a longer duration of trade. Things are looking better in the manufacture of book-making machinery. In this there has been noticeable hitherto a tolerably steady movement. Also, in consequence of the ministerial consequence of these depressing conditions there is seldom a sign of new building, extension or rebuilding of industrial establishments, from which it is self-evident that structural material works are in need of contracts. In the same rank are the pipe manufactories so far as regards heating installations, while for well casing the situation is better. The question when there will be a change in this general state of affairs meets in industrial circles a diversity of replies. Many hold the present year to be the minimum; others anticipate a further depression next year, though in any case a normal trade is not looked for within two or three years. England, whose zest for new undertakings has been much reduced by events in South Africa, fails to be a heavy purchaser, and even after the end of the African war a long time must elapse before orders come again from that side of the Channel. So, all told, the picture of our machine and iron industry just now is not especially beautiful, yet not entirely a sombre one"

Machinery, Machines, and Parts of—	April—				Ten Months Ending April—					
	1900		1901		1899		1900		1901	
	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.	Number.	Dollars.
Cash Registers	....	70 955	937	71,738	....	.....	....	684,224	1109	809.944
Electrical	....	389,608	....	520,824	....	2,276,694	....	3,295,639	....	4,865,930
Laundry Machinery	....	41,643	....	51,044	....	.....	....	343,007	....	376,243
Metal-working	....	612,287	....	269,587	....	5,410,720	....	6,007,731	....	3,527,086
Printing Presses, and parts of	....	89,142	....	67,946	....	696,868	....	1,001,443	....	905,668
Pumps and Pumping Machinery	....	263,184	....	193,298	....	2,220,236	....	2,614,744	....	1,873,513
Sewing Machines, and parts of	....	394,322	....	300,097	....	2,621,087	....	3,722 670	....	3 444,189
Shoe Machinery	....	122,238	....	69,425	....	711,706	....	1,007,434	....	704,761
Steam Engines, and parts of—										
Fire	....	.....	....	.....	1	260	1	8,135	11	18,470
Locomotive	57	709,841	28	205,300	441	3,798,219	451	4,805,375	343	3,282,753
Stationary	95	53,847	219	78,375	416	257,027	916	517,164	1093	780,517
Boilers and parts of Engines	....	200,115	....	103,509	....	961,071	....	1,436,021	....	1,403,478
Typewriting Machines, & parts of	....	269,283	....	257,446	....	1,965,753	....	2,257 872	....	2,335 446
All other Machinery, and parts of	....	1,852,116	....	1,589 957	....	15,498,038	....	17,707,291	....	17 557,669

UNITED STATES OFFICIAL STATISTICS OF EXPORTS OF MACHINERY OF DOMESTIC MANUFACTURE INCLUDING APRIL, 1901.

order, there is to be looked for in the near future a greater activity in the manufacture of book-stitching machines. In the manufacture of agricultural machinery the last few months have not been unfavorable—that is, in so far as relates to seed drills, which as a result of the widespread 'winterings' have been much bespoken and must be delivered quickly. Plows also have found a generally satisfactory market, though not a pressing one. The industry of large steam engines has much to be desired, yet, on the whole, cannot be pronounced unfavorable. Contracts for large engines for electric street railway service are moving, and, owing to the increased personal traffic and inadequacy of horse railways, will continue to move, it may be assumed, although not in the volume of good years. At present Spain is a customer worthy of consideration in this department. On the other hand, as is easy to explain from the general business situation, small power machines are in light demand. The iron foundries are very slackly employed and in unison they lament the dearth of orders, their situation not being rendered favorable by the few orders that may be coming in. In

CHICAGO MACHINERY MARKET.

Comfort may be found in any condition, if sought strenuously, and the present machine tool situation in the West is not without its redeeming features. When comparisons are made with a year ago the results are wholly satisfactory. The current strike of the machinists locally is not so serious as in the spring of 1900. Most of the small machine shops in Chicago are running, while a year ago most of them were tied up. A number of the larger shops are closed up, but even there the idleness is perhaps not so marked as in 1900. Little is heard of trouble in the interior, except at Milwaukee, though an occasional shop is tied up. But the present conditions are a truce and the future of shop activities will be determined very largely in general opinion, by the action of the convention in New York.

There is quite a demand for machine tools, notwithstanding the labor troubles. The latter exert a depressing influence notably, but have not destroyed the market. A damage which is said to be even greater than the actual time and work lost is the blow given to proposed improvements and extensions by manufacturers whose shop operations have been impaired. The idleness in Cincinnati has made some assortments of tools here incomplete, but there is understood to have been quite a large stock on hand, so that a serious shortage is not anticipated.

The Quincy Engine Company, of Quincy, Ill., has closed with the Niles Tool Works for a full shop equipment. The inquiries were for about $50,000 worth of tools, but the actual business placed is understood to have been less. The Brown Engine Company, of Milwaukee, also has placed a large order for its heavy machinery with the Niles people. It is said this company will close in a very few days for its smaller machine tools and competition for the business is quite active. The Bellaire Stamping Company, of Terre Haute, Ind., has purchased a bill of machine tools amounting to perhaps $8,000. The bulk of the business went to McDowell, Stocker & Co., of this city. Scattering trade is decidedly active. The heavy selling of machine tools in May, an exceedingly good month, may not be equaled in June, but the aggregate will be from indications quite satisfactory.

E. A. Delano has been having an exceptionally good demand for pulley molding machines and his general shop work is excellent.

Quotations.

New York, Monday, June 10.

Pennsylvania Foundry Pig Irons, Jersey City delivery, good brands:

No. 1 X.....$15 15 @ 15 50
No. 2 X..... 13 85 @ 14 25
No. 2 plain..... 14 00 @ 14 50
Gray forge..... 13 75 @ 14 25

Alabama Pig, New York delivery:

No. 1 foundry, or soft.... 15 25 @ 15 50
No. 2 foundry, or soft.... 14 75 @ 15 00
No. 3 foundry..... 14 25 @ 14 50
Foundry forge, or No. 4.. 13 75 @ 14 00

Bar Iron—Base sizes—Refined brands, mill prices on dock, 1.58 @ 1.65c.; from store, 1.80 @ 1.90c.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—From store, 1.90 @ 2.00c.

Cold Rolled Steel Shafting—Base sizes—From store, 2½ @ 2¾c.

Copper in carload lots—Lake Superior ingot, 17c.; electrolytic, 16⅝c.; casting, 16½ @ 16⅝c.

Pig Tin—28½c., for 5 and 10-ton lots, f. o. b.

Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—4c., New York.

Antimony—Cookson's, 10⅜ @ 10½c.; Hallett's and U. S., 8¾c.; Hungarian and Italian, 8⅝c.

Lard Oil—Prime City in jobbing lots, 67 @ 68c.

Commercial Bevel Gears for Shafts at any Angle.

BY W. C. CONANT.

By commercial gears are meant cast gears, listed as standard in the catalogs of various manufacturers for driving shafts at right angles to each other, and the object of this article is to show that such standard bevel gears may be used for driving shafts whose center lines intersect at any other given angle. This method, as far as the writer knows, has never been described in any work on the principles of mechanism, and is certainly not generally known to engineers or millwrights.

In many instances where it is necessary to transmit power through shafts that intersect at an angle other than 90 degrees, the making of special bevel-gear patterns that probably will never be used again, is an unwarranted expense, and clumsy expedients are usually adopted and much mental energy expended in efforts to find a substitute for such special gears. It is therefore believed that the writer's method of solving this problem will be of interest and use to the readers of the "American Machinist."

After expending time and thought to so design a pair of bevel gears with their special angles that they will properly run together as a pair, it does not follow as a natural logical sequence that either member could form a part of any other combination. By inspection of Fig. 1, it is obvious that gears B and C, members of the right-angle pairs BA and CD will run correctly together, as their generating cones intersect at the common point O. Proceeding a step further, from Fig. 4, it is equally evident that gear A may mesh with an indefinite number of gears B, C, D, etc., provided that the generating cones intersect at the common point O, and the gears B, C, D, etc., may be members of right-angle pairs, each combination giving different angles of shafts and different speed ratios $\frac{A}{B}$, $\frac{A}{C}$ and $\frac{A}{D}$. In general one member of a pair of right-angle bevel gears may be arranged to run with a suitable member of another pair of right-angle bevel gears, giving any required speed ratio and angularity of shafts, the requirements being that such gears be selected that their pitch cones will intersect at the same point, and that they have the same pitch and face.

In practice the conditions given are two shafts whose center lines intersect at any fixed angle, to run at a given speed ratio, to find bevel gears of standard pattern that will fill these requirements.

The formulas developed in the following paragraphs have been used with satisfactory results by the writer in numerous instances that required the transmission of power by shafts at odd angles, and in each case the gears used were selected from standard lists published in gear catalogs.

Referring to Fig. 1, let OM and ON be the center lines of two shafts, and let C and B be the pitch lines of any two bevel gears that will give the required speed ratio. Draw OP perpendicular to center line OM and dotted line from R perpendicular to OP; this latter line to represent the pitch line of a gear mating with B to form a right-angle pair. By a similar construction draw D to form a right-angle pair with C. It is evident from figure that any diameter gear B having a ratio with its mate A of $\frac{B}{A}$ and any diameter gear C having a ratio with its mate D of $\frac{C}{D}$ will run correctly together provided ratio $\frac{B}{C}$ is a constant. Therefore to solve the problem, it is only necessary to find ratio $\frac{B}{A}$ and $\frac{C}{D}$ selecting proper member from each pair. The rule for determining whether pinion or gear is to be selected will be given later.

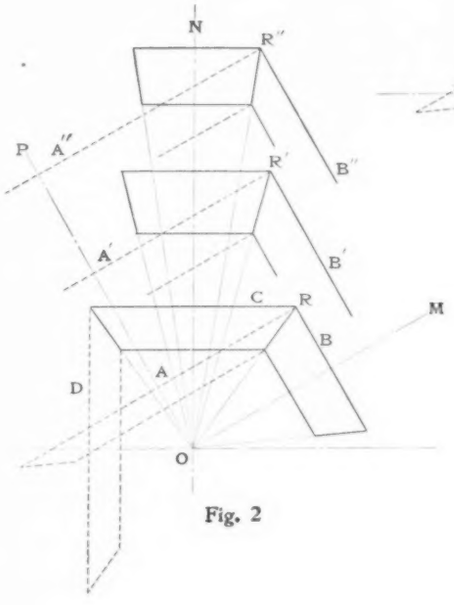


Fig. 2

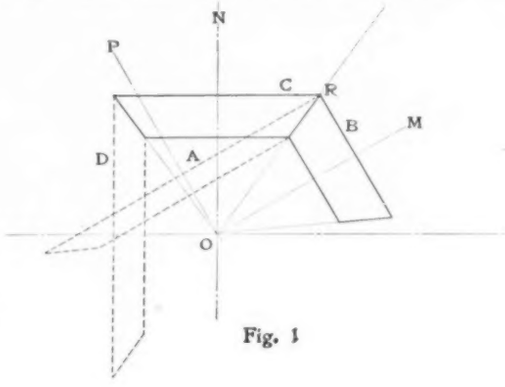


Fig. 1

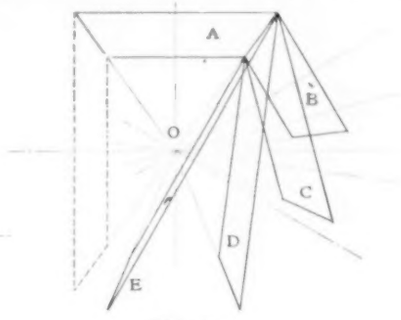


Fig. 4

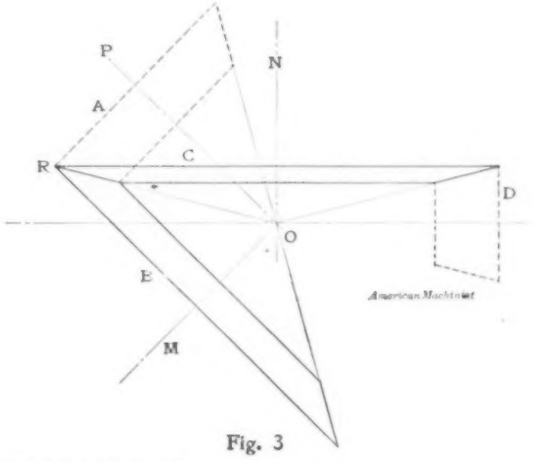


Fig. 3

COMMERCIAL BEVEL GEARS FOR SHAFTS AT ANY ANGLE.

Angle MON = angle MOR + angle NOR (1)

Since

$$OR = \frac{B}{\text{sin. } MOR} \text{ and } OR = \frac{C}{\text{sin. } NOR}$$

$$\text{therefore } \frac{B}{\text{sin. } MOR} = \frac{C}{\text{sin. } NOR}.$$

Transposing, $\text{sin. } NOR = \frac{C}{B} \text{ sin. } MOR$

$$\text{Let } \frac{C}{B} = K,$$

then $\text{sin. } NOR = K \text{ sin. } MOR$ (2)

From a table of natural sines select such

values for angles $M\,O\,R$ and $N\,O\,R$ that sin. $N\,O\,R$ is R times sin. $M\,O\,R$, and that the sum of the angles is equal to angle $M\,O\,N$, thus satisfying equations (1) and (2).

Proceed next to find the value of the ratio $\frac{A}{B}$:

$$\text{Since } O\,R = \frac{B}{\text{sin. } M\,O\,R}$$

$$\text{and } O\,R = \frac{A}{\text{sin. } R\,O\,P} = \frac{A}{\text{cos. } M\,O\,R}$$

$$\text{therefore } \frac{B}{\text{sin. } M\,O\,R} = \frac{A}{\text{cos. } M\,O\,R}.$$

$$\text{Transposing, } \frac{A}{B} = \frac{\text{cos. } M\,O\,R}{\text{sin. } M\,O\,R}$$

$$\text{Let } \frac{A}{B} = r$$

$$\text{then } r = \frac{\text{cos. } M\,O\,R}{\text{sin. } M\,O\,R} \qquad (3)$$

In the same manner we can prove that

$$\frac{D}{C} = r' = \frac{\text{cos. } N\,O\,R}{\text{sin. } N\,O\,R} \qquad (4)$$

While this may seem a tedious process, in practice it is a very simple operation, and the following solution of an actual problem will show both the method and its simplicity. Suppose that power is to be transmitted through the two shafts whose center lines intersect at an angle $M\,O\,N$ of 60 degrees, and that the speed ratio $\frac{C}{B}$ is to be 2 to 1. As angles are nearly proportional to their sines, it becomes a simple matter to determine by inspection of table of natural sines that sin. 41° (.656) = 2 sin. 19° (.325) nearly, and that 41° + 19° = 60°. Therefore angle $N\,O\,R$ = 41° and angle $M\,O\,R$ = 19°, substituting the values of the sines and cosines of these angles in equations (3) and (4), we get $r = \frac{.9455}{.3255} = 2.9$ and $r' = \frac{.7547}{.6560} = 1.15$.

From a catalog list we now select the pinion of a pair of right-angle gears having a ratio of 2.9, and we will suppose that a pair found having 17 and 50 teeth answer the requirements for strength. Since the speed ratio of the shafts is 2, the gear to run with the 17-tooth pinion must have $2 \times 17 = 34$ teeth, and it must come from a pair in which it mates with a gear having $34 \times 1.15 = 39$ teeth. Therefore the 17-tooth pinion selected from the first pair and the 34-tooth pinion from the second are the gears required.

By referring to Fig. 2, observe that B is the pinion of the pair B-A, and that when $M\,O\,R = 0$, ratio $\frac{B}{A} = 0$, and that this ratio constantly increases, until $M\,O\,R = M\,O\,R' = 45°$, when $\frac{B}{A} = 1$. When $M\,O\,R$ becomes greater than 45°, the gear B becomes the larger member of the pair B-A, and the ratio $\frac{B}{A}$ continues to increase in value from 1, when $M\,O\,R = 45°$ to infinity when $M\,O\,R = 90°$.

From these facts the following rule is deduced: When the angle $M\,O\,R$ is less than 45°, use the pinion of the pair B-A, and conversely when the angle $M\,O\,R$ is greater than 45°, use the gear of the pair B-A. As a corollary it follows that the same rule applies to the pair D-C, using the angle $N\,O\,R$ as the critical angle.

As the diagrams in Figs. 1 and 2 are drawn with angle $M\,O\,N$ less than 90°, Fig. 3 is drawn to show angle $M\,O\,N$ greater than a right angle. It will be observed that the obtuse angle uses larger gears than the acute angle, of which advantage may be taken in cases where strength is needed and consequently large gears required.

While it will generally be possible to find a pair containing one of the required gears, it will usually be found more difficult to find a pair from which the mating gear can be selected. That is to say, after having found the 17-tooth pinion, it will be difficult to find a 34-tooth pinion belonging to a pair having a ratio of 1.15 with same pitch and face. There is also the danger that the teeth of the two pairs from which the mating gears are chosen may have been designed by different systems, and that therefore the mating gears will not run well together. For these reasons it is much better to use two gears of the same size—that is, making $\frac{C}{B} = 1$, the required speed changes being made at some other point.

In the example given above, if the required speed ratio were 1 instead of 2, angle $N\,O\,R$ would equal $M\,O\,R$, or 30°. Substituting the values of the sines and cosines in equation (3), we would get $r = \frac{.866}{.500} = 1.73$, and we would select the pinion of a pair having 24 and 42 teeth and a speed ratio of 1.75. Although this ratio varies slightly from the one required, it is sufficiently accurate for the class of work in which cast gears are used; at least this method gives the correct ratio, and whether gears available are accurate enough for job in hand must be decided by designer.

It is safe to say that any reasonable ratio may be found in some catalog, and therefore whether gears of required ratio are found to be commercial or not, depends solely upon the number of such catalogs at hand.

Back Rests for Grinding Machines.

An important advance in back rests for grinding machines has been made by the Brown & Sharpe Manufacturing Company, and of it we give illustrations herewith. Its aim is to enable all work of any length or diameter within the capacity of the machine to be ground much more rapidly than is possible by the older methods, and with the certainty that it will be round and of uniform size throughout when finished.

Fig. 1 shows the Brown & Sharpe plain grinding machine with a long piece of work in position and with five of the back rests in use—the distance between the rests being from six to ten diameters of the work. An end elevation of the work and a side elevation of the rest are shown in Fig. 2. The shoe *a* is of a radius to suit the finished diameter of the work and is pressed against it by the light springs *b c* having thumb-nuts *d e* to adjust their tension. The spring *b* bears against the sleeve nut *f* of the screw *g*, which in turn bears against the heel of the shoe *a* and causes it to turn about its trunnion *h*. Before the work reaches its final size the shoe is depressed and thus lifts screw *g* and nut *f* against the pressure of the spring *b*. The correct adjustment of the parts is, however, such that when the work reaches the final size the nut *f* will bottom in its cavity and hence the spring can then push the shoe no further.

The piece *i* which carries the shoe is supported on a roller mounted on the stud *j*. Its rear end is connected to a link *k* having a stop screw *l* and spring *c* with thumb nut *e* for adjusting its tension. Stop screw *l* is so adjusted that when the work is to size it bears against its seat by the pressure due to the spring *c*. With the work out of the machine, spring *b* will force nut *f* to its seat and spring *c* will force link *k* to the left until screw *l* reaches its stop, and the shoe *a* will thus occupy a defined position, but with the work in place and before it reaches size, the piece *i* will be pushed backward and the shoe *a* will be swung downward on its trunnion. The pressure of the springs is only sufficient to prevent vibration and to resist the pressure of the wheel. As the grinding proceeds the shoe *a* approaches the limiting position, which, however, it can occupy only after the work has reached the correct size and once in that position the grinding stops, as the shoe ceases to exert further pressure on the work.

Successive pieces may be introduced and ground with the certainty that except for the wear of shoes and emery wheel they will be uniform in size. Wear of the wheel is compensated for in the usual way and wear of the shoes by adjusting the screws *g* and *l*.

The action of the rest after it is once correctly set will, we think, be clear from the above description, but it remains to show how the adjustment is made. The piece of stock and shoe to suit the finished size being in place, screws *e*, *g* and *l* are slackened and spring *b* is given a light pressure through screw *d* to force the nut *f* to its seat. Screw *g* is now tightened to bring the shoe in contact with the work at both its bearing points and screw *l* is then turned forward to gentle contact, after which *e* is tightened to give a light pressure to spring *c* and hold *l* in contact with its seat. The grinding is now begun. As it proceeds the shoe soon loses contact, as the nut *f*

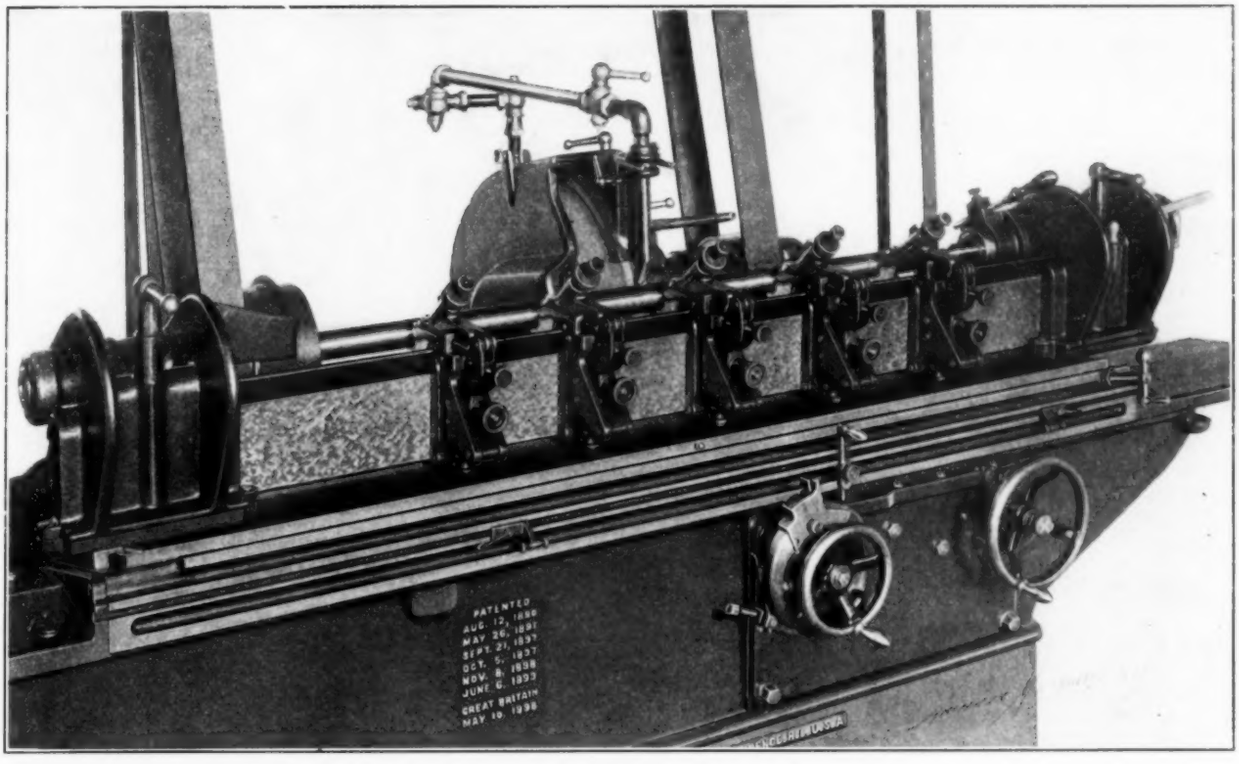


FIG. 1. PLAIN GRINDING MACHINE WITH BACK RESTS IN POSITION.

and screw *l* touching bottom prevent its following up the gradual reduction in the diameter of the work. Screw *g* is therefore tightened from time to time to maintain the contact and screw *l* is slackened to maintain the diameter, the diameter being watched at each rest as the grinding proceeds with the micrometer. When the first piece is finished the next piece is put in and ground without disturbing the adjustments, until wear of the shoe makes that necessary, as already explained.

The Engine Exhibit at Buffalo.

The Lane & Bodley Company, of Cincinnati, has addressed the following letter to other firms that exhibit engines at Buffalo:

"Gentlemen—The writer has just returned from the Pan-American Exposition at Buffalo, where we have an engine on exhibition. You are also exhibitors. We are addressing this letter to all who have engines installed in the cellar.

"We believe that all engine exhibitors have been imposed upon. We believe that 99 per cent. or more of the visitors would spend a week on the grounds, and would leave without knowing there is an engine exhibit.

"The engines are down in a hole, and there is nothing to indicate that the hole exists, nor that it contains an engine exhibit. This hole is roofed over as low down as possible, to clear the tops of the flywheels of the engines, and a few inadequate skylights are inserted. It is entirely boxed in, and when the weather gets warm, will be a sweat box in which we do not believe it will be possible for men to stay.

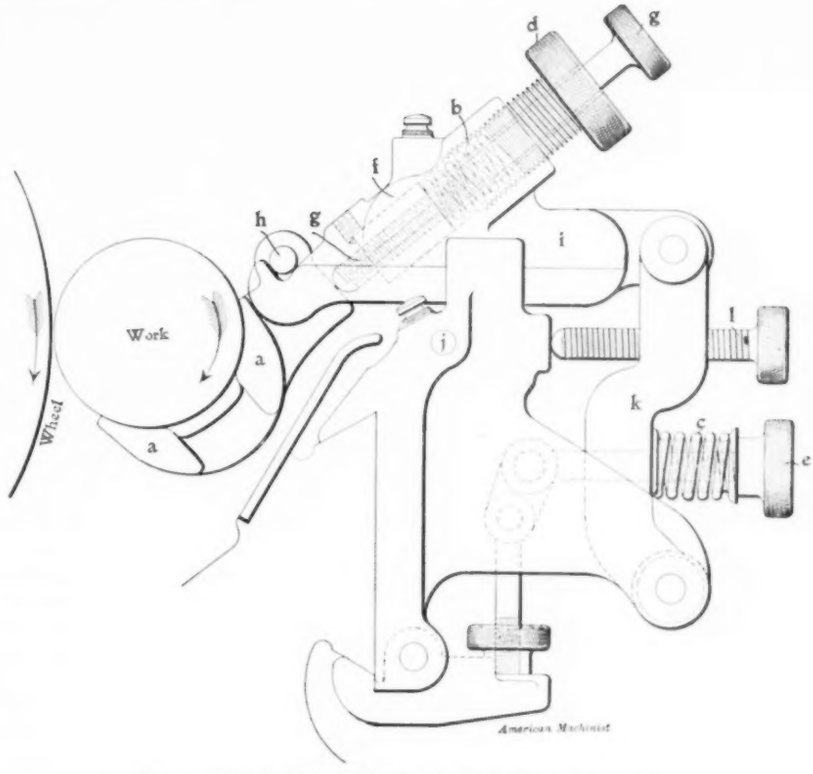


FIG. 2. ACTION OF BACK REST IN SUPPORTING THE WORK.

"We request that you immediately write to the Exposition authorities, and urge that the roof over the engine exhibit, which is a temporary affair, be raised to the level of the roof of the machinery building, and that the inner partitions of the machinery building be removed, so that visitors may look down upon the engines from the machinery building, and that suitable conspicuous access be provided to this subterranean exhibition space, and that conspicuous signs be

placed in various parts of the machinery building, calling attention to the fact that there is an exhibition of steam engines, notwithstanding the appearances to the contrary.

"We believe a prompt protest and request for a satisfactory remedy will be effective now, but would not be later.

"Yours truly,

"THE LANE & BODLEY COMPANY."

The D'Auria Air Compressor.*

BY HENRY G. MORRIS.

The present paper calls attention to a new form of air compressor, so extraordinary in character that, had I not built several of them and seen them work satisfactorily, I would hardly dare to bring it forward as an accomplished mechanical fact: namely, the d'Auria air compressor, built on the same principle as the d'Auria pumping engine.

This is, as Fig. 1 shows, a non-rotative compressor of the duplex type. So far as steam economy is concerned, it may be said to have less limitations than even a crank and flywheel compressor, for the simple reason that, while in the latter the high degree of steam expansion calls for heavier flywheels, heavier crank shafts, etc., the moving parts in the d'Auria compressor are not in the least affected by the degree of steam expansion, and the machine works as well with a high as with a low expansion. Figs. 2 and 3 explain themselves.

Since there is no mechanism of levers, etc., employed to equalize the propelling force and the resistance at every point of the stroke (such as is used, for instance, in a Worthington high-duty pumping engine), the question arises, how perfectly smooth action is attained in the d'Auria compressor, starting at the beginning of the stroke with a high initial pressure of steam against no resistance, and ending the stroke with a propelling force practically *nil*, and resistance at a maximum.

This result is accomplished by the d'Auria "hydraulic compensator," which is a cylinder, fitted with a plunger carried by the same piston rod which connects the steam and the air piston. The ends of the compensator cylinder communicate with each other by means of a loop of pipe, turned into the form of a very rigid bedplate, which adds to the strength of the machine, and preserves, under all conditions, the alinement of the piston rod. This cylinder and pipe are filled with water or any other liquid, and, as there is no loss of liquid beyond that which may leak through the stuffing boxes, are easily kept full from any source of water supply through the small pipe and two check valves, shown in Fig. 3.

When the compressor is in action, the liquid column contained in the compensator pipe is affected reciprocally, to and fro, by the plunger and acts in exactly the same manner as a balance wheel in a watch, taking up the excess of energy in the first half and giving it back, with an exceedingly small loss due to friction, in the second half, of the stroke.

The action of this compensator is so perfect that the machine is never bolted down to the floor on which it stands, and, under such conditions, can be run at a high rate of speed without vibrations. I have seen an 8x9x8-inch compressor of this type work suspended in the air from chains, and also run while on rollers, and another of the same size making 340 strokes per minute without being bolted to the floor—and under these conditions I was able to balance upon it a five-cent piece on edge.

These compressors have no dead centers. The cycle of their action being limited to the period of one stroke, they are able to start and stop instantly, and, if fitted with a sensitive pressure regulator, they will stop completely on a small variation of air pressure and will start promptly when that pressure falls slightly below the normal.

It may be asked, What would be the effect of a sudden release of load on the compressor, such as might happen by the breaking of the air pipe? This contingency is met in the d'Auria compressor, as in

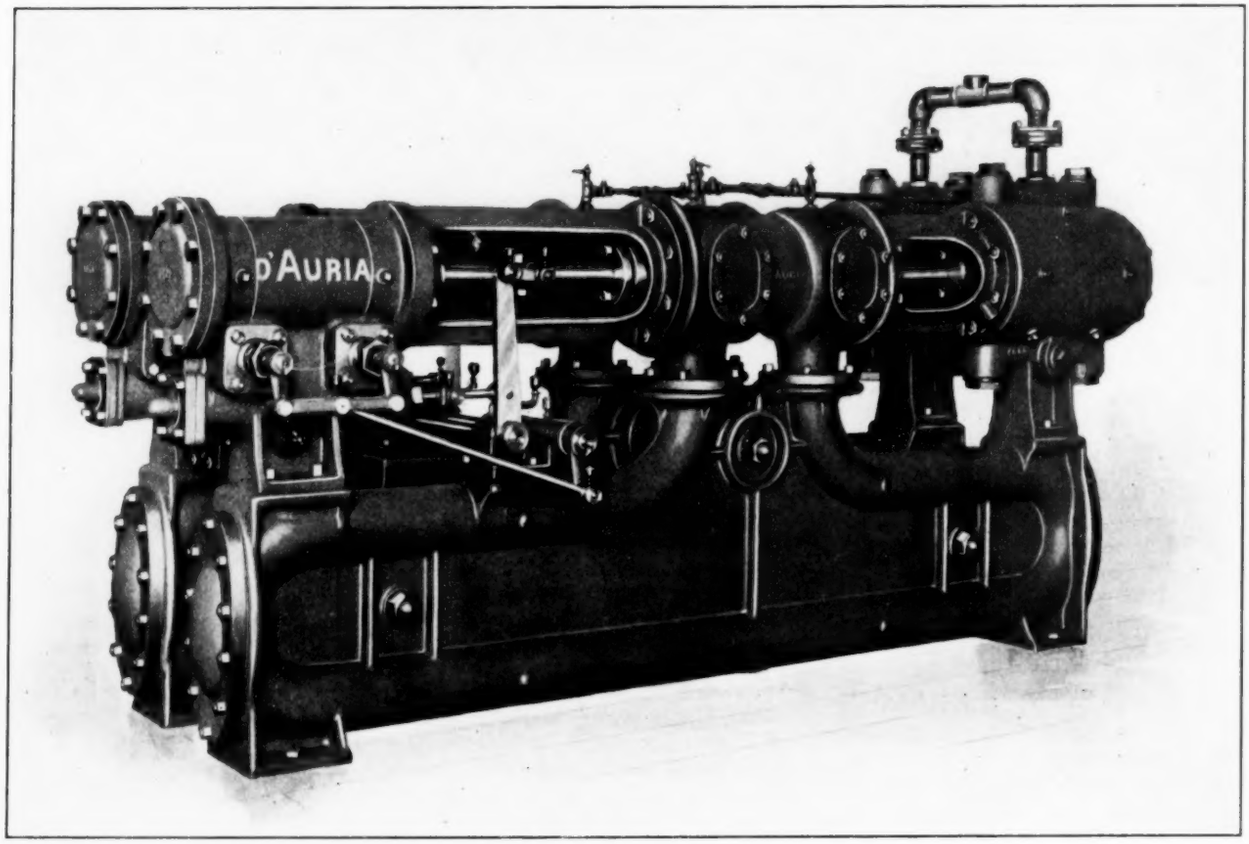


FIG. 1. THE D'AURIA AIR COMPRESSOR.

* From a paper read before the American Institute of Mining Engineers.

the d'Auria pumping engine, by a simple and effective device. The exhaust steam in the steam cylinder is cut off by the piston itself about 1.5 inch from the cylinder head, and from this point on a considerable amount of steam cushioning is done in the cylinder, stopping the piston, under ordinary conditions, at about ⅜ inch from the cylinder head. Of course, this ⅜-inch clearance is filled up with steam at boiler pressure, which, while it does no harm, does a considerable amount of good by keeping the piston and cylinder head hot when steam is admitted. On the other hand, the compensator plunger has a number of slots, which, in case the stroke becomes longer than normal (that is, if the clearance becomes less than ⅜ inch), overrun the bearing of the plunger and open a by-pass for the column of water which is pushing the plunger forward. Thus the pressure on both sides is equalized and the pistons are prevented from striking the cylinder head. Of course, this device comes into play only when the load is suddenly released. Under ordinary conditions—that is, with ⅜ inch of clearance in the steam cylinder, the by-pass in the compensator will not open.

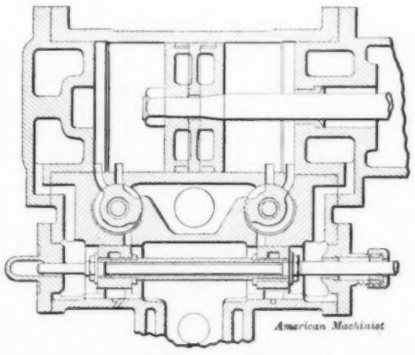


FIG. 2. SECTION THROUGH STEAM END.

The machine here illustrated is a small one. In larger sizes, the d'Auria compressors are made compound, both in air and steam, and fitted with the most approved steam and air valves to insure economy of steam. A d'Auria compressor of 3,000 cubic feet capacity per minute, compound in steam and air, with inter-cooler all complete, weighs about 46,000 pounds, occupies a floor space of 25 by 8 feet, requires no other foundation than a floor to support its weight, and does not need even to be bolted to the floor. A compressor of the crank and flywheel type, capable of doing equally efficient work, and of the same capacity, would occupy a floor space of about 56 by 18 feet and its flywheel alone would weigh 45,000 pounds, the total weight of the machine being probably about 170,000 pounds.

Where space is a consideration the new type offers considerable advantages, occupying only one-fifth as much area as the former type. In weight it is as one to four, involving much saving in the cost of foundations, which is an important item. Moreover, it can be moved from place to place without any trouble, being, in the full sense of the word, a portable machine. No matter what its size, it will always start and stop promptly by opening or throttling the steam, without any dead center.

The principles involved in the d'Auria compensator have been recognized and stated by Prof. Goodman, of Victoria University, Leeds, England, in his work on "Mechanics Applied to Engineering."

Spacing for Prime Numbers on the Universal Milling Machine—Errata.

BY WALTER GRIBBEN.

Mr. Luper's table of gears, in your issue No. 20, I consider a most valuable acquisition to machine-shop literature, but there seem to be a few errors contained in it, notwithstanding the corrections by Messrs. Brown & Sharpe. I do not suppose it would be exactly fair to shove this off on the compositor, so it may be due to the inferior quality of the ink used in your pressroom.

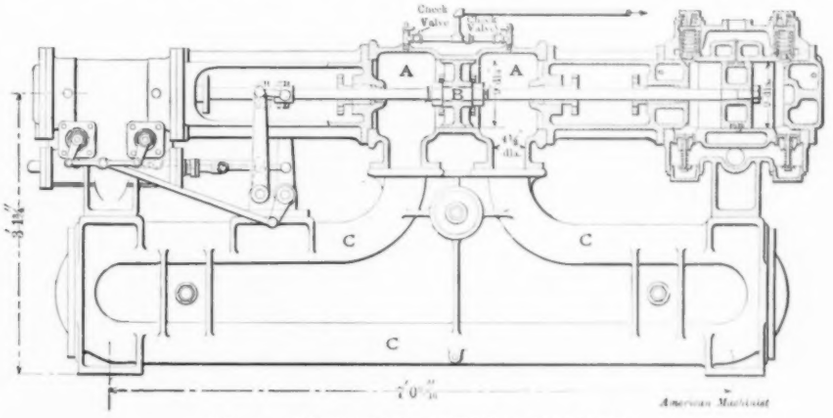


FIG. 3. LONGITUDINAL SECTIONAL ELEVATION.

As near as I can figure it out, 105 teeth have no business in this table, as that number can be cut in the orthodox way by moving 8-21 of a turn.

In the case of 134 teeth, indexed for 140, the gear ratio should be 7 to 12, or gear 28 on worm and 48 on spindle. I have not tried these gears in place; but they are used to cut 67 teeth, so they should mesh properly.

For cutting 159 teeth, indexed for 160, a gear ratio of 4 to 1 would be called for; which condition is not satisfied by gears 64 and 48 as given in the table, unless the compound stud is used with 24 as first gear and 72 as second gear, and this combination will not mesh properly. It can be done, though, by indexing for 160, using 72 on worm, 24 as first gear on stud, 64 as second gear on stud, 48 on spindle, with no idler.

For 161 teeth, indexed for 168, the table calls for two idlers, which should be one.

Remarkable Behavior of a Naphtha Gas Machine in a Fire.

The following letter from the American Gas Furnace Company explains itself. Under the circumstances we think the note of exultation in the letter will be admitted to be quite justifiable:

Editor American Machinist:

In your issue No. 20 you noticed the installation of one of our gas plants at the new and extensive laundry works of Messrs. Morey & La Rue, Elizabeth, N. J. On the same day these works were completely destroyed by fire, having been in operation only about two weeks.

It was generally known that a naphtha gas machine was in operation in these works, and the first newspaper reports assigned to the presence of that machine the origin of the conflagration, reporting that it had "exploded," and other reports said that it had "added to the fierceness of the conflagration," but as a matter of fact, since verified by hundreds of eye-witnesses, these reports were false. There is no doubt about the fierceness of the conflagration and the complete destruction of the plant *except only* the gas machine, which stands there amidst the ruins of the whole plant perfectly uninjured in its working parts, and although blistered in spots from the heat, is the only thing which neither exploded nor was destroyed, and it is in perfect readiness to resume operation at a moment's notice.

While ten years of close study and experimenting devoted to the safe handling of naphtha in gas making gave us assurance that our gas machine embodies every conceivable provision for safety, the severe tests to which the machine has now been subjected for the second time should convince even the most skeptical that there are now no safer means for generating gas in a detached factory plant than those embodied in our machine.

As you will see from the photographs herewith submitted [reproduced in Figs. 1 and 2], and which were taken on the day following the fire, the little gas-house below which the storage tank is buried, and in which the machine is located, is

FIG. 1. GENERAL VIEW AFTER THE FIRE.

charred and burned. The sash and windows are destroyed and the door nearly burned through, showing that the flames found their way to the machine, and necessarily produced vapors in the generator and feeding tank which contained the naphtha required for the operation of the machine. These vapors necessarily expanded, and would have burst the machine but for the provision made against this very contingency, which we call a "water seal sack." The vapor as it expanded was promptly vented as soon as its pressure rose to about 2 pounds to the square inch. When this pressure was reached it displaced the water in the water seal, and the vapor was discharged through the pipe connected with it into the open air, where it harmlessly burned from a nozzle.

When the fire was over, the machine cooled and the generation of vapor was stopped, and as soon as the pressure was reduced below 2 pounds the water flowed back into the "sack" and the machine was again hermetically sealed. The storage tank under the machine could not explode under any known law of physics, being solidly confined by the earth and filled with water so far as it was not filled with oil, both under slight pressure from the water reservoir above the tank, so that no air space existed anywhere, and no air, without which an explosion is simply impossible, could get into any part of the system. How perfectly tight the machine is, is shown by the mercury gage, which you can observe in the photograph [Fig. 3]. This gage is used to ascertain the pressure with which the air is forced into the machine and the gas out of it, and as it stood when the photograph was taken, shows a vacuum in the machine, caused by the cooling of its contents and subsequent contraction, and the vacuum thus created could not be filled because the whole machine was too tight to admit air through any joint or any valve.

We were the first to demonstrate the practicability of safely using naphtha in gas making, and therefore believe that the present is the proper occasion to secure a more general recognition of the fact that naphtha can be safely handled, contrary to the very natural prejudice which gas making from naphtha has heretofore encountered.

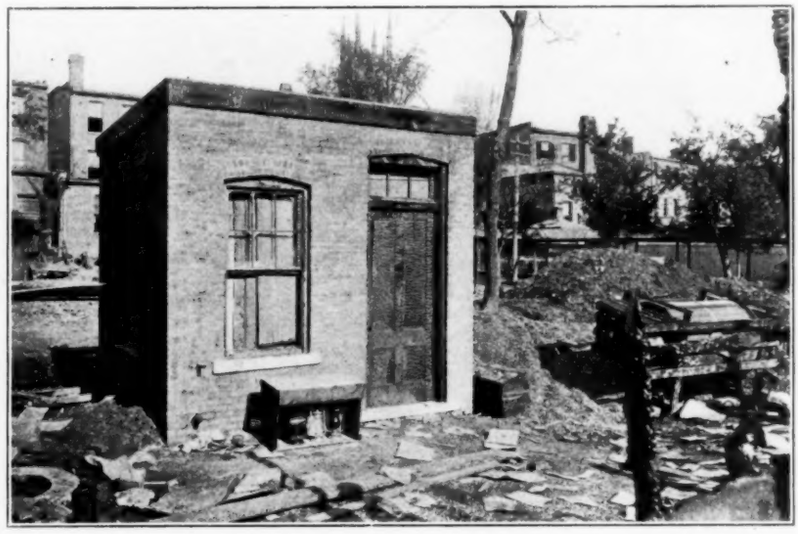


FIG. 2. EXTERIOR OF THE GAS HOUSE AFTER THE FIRE.

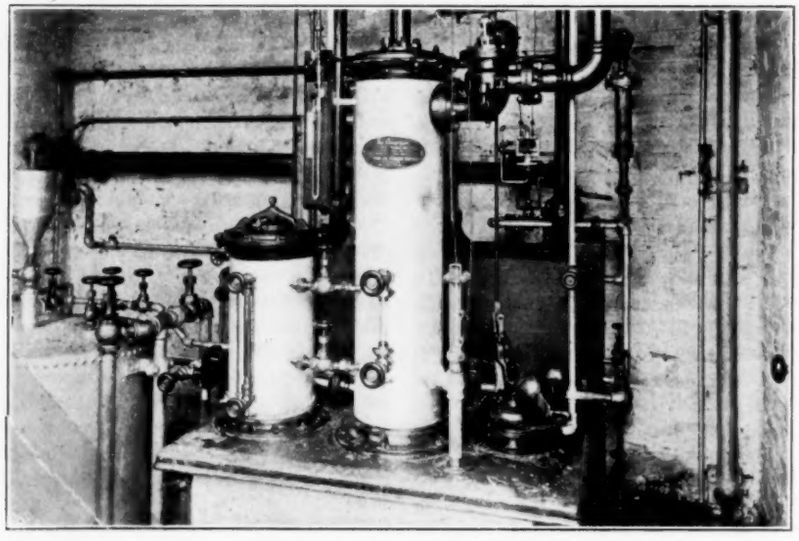


FIG. 3. THE GAS MACHINE AFTER THE FIRE.

Incidentally it may be mentioned that Messrs. Morey & La Rue received 10 barrels of naphtha the day before the fire. These barrels lay between the gas-house and the burned building, as shown in photograph, and are charred on the outside. Had these barrels been empty they would have exploded and added materially to the blaze. Under our system, however, they are full of water and could not explode; hence they, too, escaped the conflagration which surrounded them. As the oil in the barrels was transferred to the storage, it was replaced by water under pressure. This is in accordance with the invariable rule governing our whole

system, according to which no air space is allowed at any time in connection with a naphtha storage. E. P. REICHHELM,
For AMERICAN GAS FURNACE CO.

A New Automatic Screw Machine.

The accompanying illustrations show a new automatic screw machine—the product of the Automatic Machine Company of Greenfield, Mass.—which has some important features.

First of these is the method of camming. The cam drum is arranged with T-slots, as shown, and the cams are substantially made of cast iron. An assortment of cams of various angles, sufficient for a great variety of work, is furnished with the machine and, these being properly machined to fit the drum, may obviously be set up with very little loss of time. Substantial covers, not shown, are provided for the cam drums, which are thus entirely enclosed and protected from chips and dirt.

The machine is driven by a single belt, the manner in which the feed motion is taken from this belt being shown in Fig. 2. The chief advantage of this method of driving is that it is impossible for the feed to continue to act and do damage in case the main belt runs off the pulleys or parts at the lacings. The circular gear case shown behind the inclined shaft from the feed belt pulley contains a sun and planet train of gears which is made to act by a suitable lever connection and thus accelerate the feed and bring the tools up to position with corresponding saving of time. The hand wheel below the belt pulleys is for traversing the feed by hand, a clutch being fitted to the hub of this wheel for connecting or disconnecting the power feed.

In case one or more of the turret holes are not occupied by tools the turret can be adjusted to turn past such holes without stopping and without making the feed traverse.

Fig. 2 shows that screws may be slotted by a slitting saw and thus be completed on delivery from the machine. For this purpose they are gripped by a chuck held in one of the turret holes and by it removed from the position where the turning and threading are done. This chuck in turn delivers the screws into the sheet metal spout shown in Fig. 2, instead of, as usual, dropping them into the pile of chips from which they must be picked out by hand.

Three cross slides are provided, one of which is vertical. They are arranged upon the headstock, instead of upon the frame as usual, thus shortening the turret slide and putting the guideways out of the way of falling chips. The slides are independent of one another and each one is fitted with a fine adjustment.

A principle is introduced into the method of supporting the machine that was first used by Professor Sweet a quarter of a century ago. One pair of legs is rigidly bolted to the oil pan as usual, but the other is connected by a pivot. The machine is thus really supported on three points, although apparently on four. The purpose of this is of course to prevent an uneven floor—and all floors are uneven—from twisting the machine. To avoid any tendency of the machine to vibrate on this pivot under the torsional strains of the cut, two supplementary bolts are provided which are tightened after the machine has "found itself" on the floor.

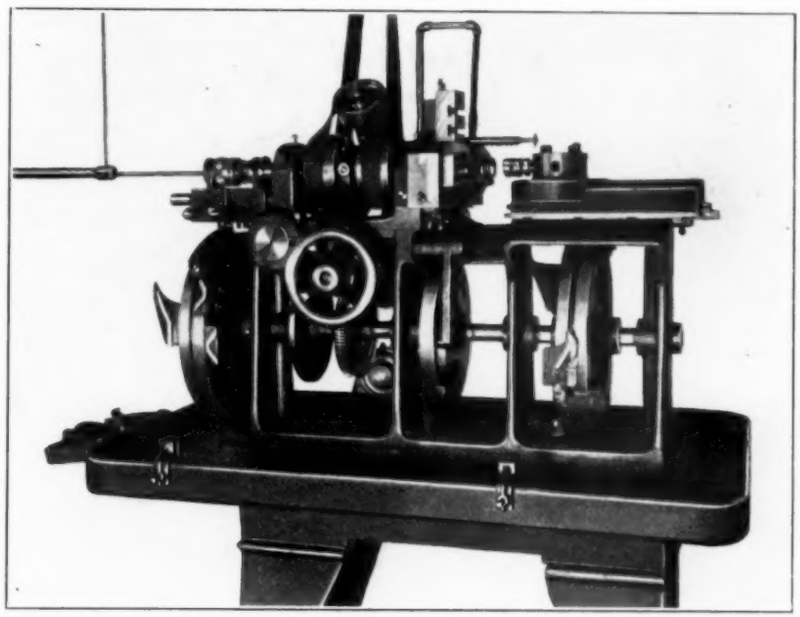


FIG. 1. FRONT VIEW OF AUTOMATIC SCREW MACHINE.

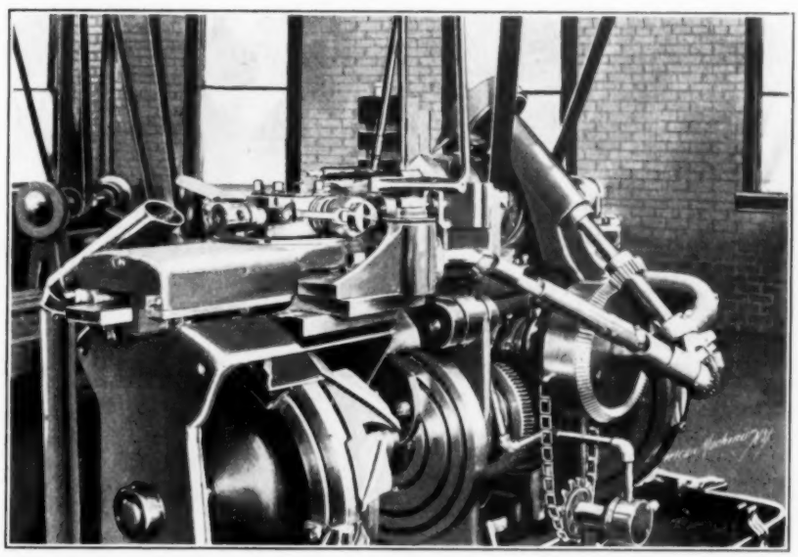


FIG. 2. REAR VIEW OF AUTOMATIC SCREW MACHINE.

A bill is before the British Parliament to permit the construction of an express mono-rail electric railroad between Liverpool and Manchester. The actual speed, after allowing for stops and acceleration, is to be 110 miles per hour.

Three Box Tools and Some Other Fixtures.

BY A. H. CLEAVES.

The accompanying cuts will illustrate a number of special box tools for turret lathe work that have been well tried and found valuable in practice. Figs. 1 and 2, showing a plan and front elevation of one of the three, may be described as follows:

The shank *A* carries a drill or any tool needed for end work, and a forming tool *B* of the round order is held on the stud or post *C* in the movable piece *D*. The latter has a tongue *F* which slides in a slot in *G*; the plate *E* fastened to the tongue *F* keeps the sliding piece *D* in place. The handle *I* pinned in the frame *G* and connected by the bar *H* with *D* moves the latter. The bushing *J* in the

block *K* guides the work and in the open space backs it for the forming-tool cut. The stop-screw *L* with check nut regulates the depth of the forming-tool cut, and *M* is a shield of thin metal attached to *D* to keep the chips out of the slide. The principal advantage of this class of tools consists in getting positive and concentric cuts regardless of any wobbling movement in the turret.

In Figs. 3, 4 and 5 another is shown, in which the point of interest is the position in which the tool *N* cuts the metal, doing so on the end vertically instead of on the top or side horizontally. The cutting corner of the tool is seen best at *O*, Fig. 4, and *P*, Fig. 3. This is a very effective tool, and many believe that there is a special advantage in having the cut on the end of the tool.

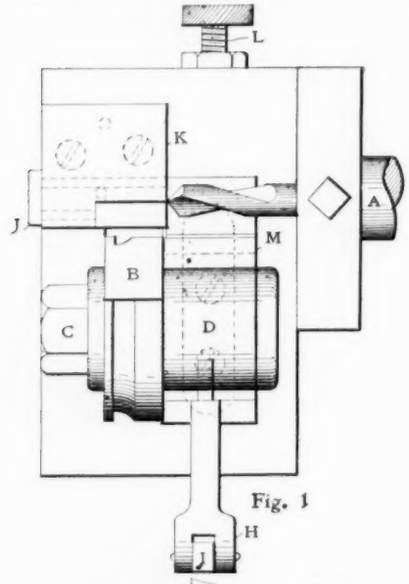


Fig. 1

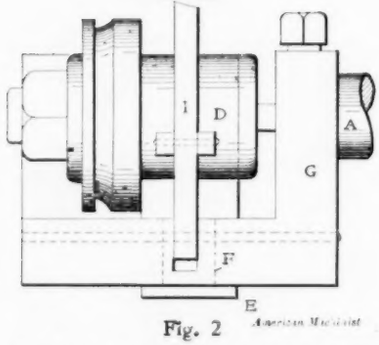


Fig. 2

A BOX TOOL WITH MOVABLE FORMING CUTTER.

Another one of the boxers, seen in Figs. 6 and 7, was used successfully for grooving rollers for a typewriter carriage. Running on a round rod similarly to the position of tool and work in Fig. 6, it was necessary to have the rim and center hole concentric, and this secured the required smoothness and absence of friction in the action of the carriage. The center hole is made in the roller and guides the work on the center pin *Q*. Another box tool of the same kind cuts a second arc of a smaller circle in the roller, as shown by the dotted line *R*. This further lessens the friction of the roller on the rod by reducing its bearing surface to the two points *S* and *T*. The cutting tool *U* passes over the work, and once set is always set, as it can be removed for grinding without changing the adjusting screws *V V V V*. A check nut and tongue washer at *W* take up the lost motion in the feed screw *X*. The tool U is run out like a lathe center for removal.

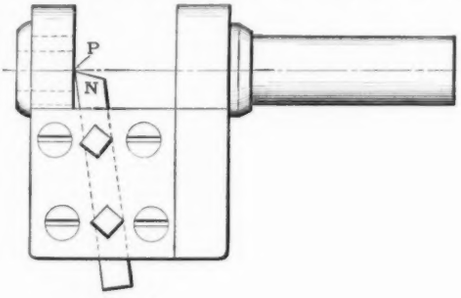


Fig. 3

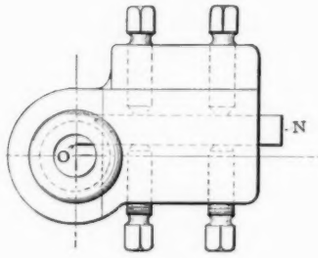


Fig. 4

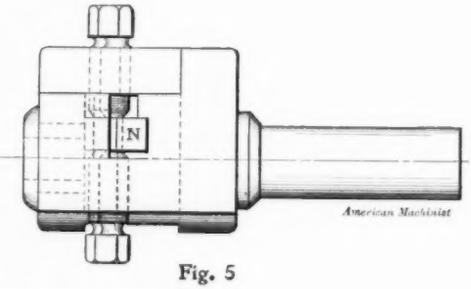


Fig. 5

BOX TOOL WITH END-CUTTING CUTTER.

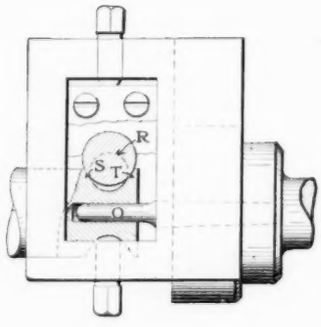


Fig. 6

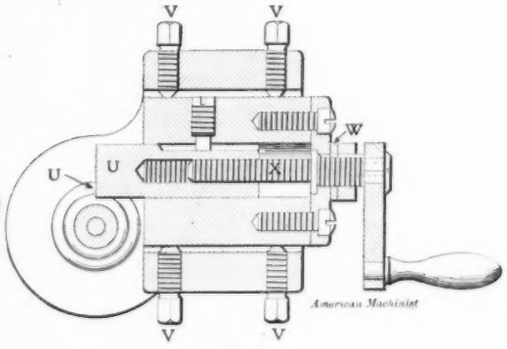


Fig. 7

BOX TOOL FOR FINISHING ROLLERS.

TOOLS FOR COUNTER-SINKING RIVETS.

Figs. 8 to 11 illustrate a process employed in making a lot of rivets with a sink at each end for spinning the same in the work. *A A A* are tool holders fitting the turret holes. In Fig. 8, *B* is a holder for the centering drill and guide bushing. The point of screw *C* locates and secures *D* and at the same time fastens the drill, which is backed up with the screw *E*. The bushing *F* drawn over the centered piece *G* turns back any burr made by the drill, so that *G* is ready to enter the cutting-off rest *H*, Fig. 9. This bushing *I* is half open where the work comes which falls out when cut off. The cutting-off tool should not touch the edge of the bushing, else it will nick it and score the work by it.

Figs. 10 and 11 show the method of holding to center the second end. The work *J* is placed part way in *K* with tweezers and pushed home with the drill. Then the loose tongue *L* is held in place and tightened with the thumb-screw *M*. After *J* is centered *M* is loosened, when the pump-pin *N* shoots the piece *J* out of the chuck. *O* is pressed tight on to *P*, and *L* is made of a segment of the latter and must loosen the work readily.

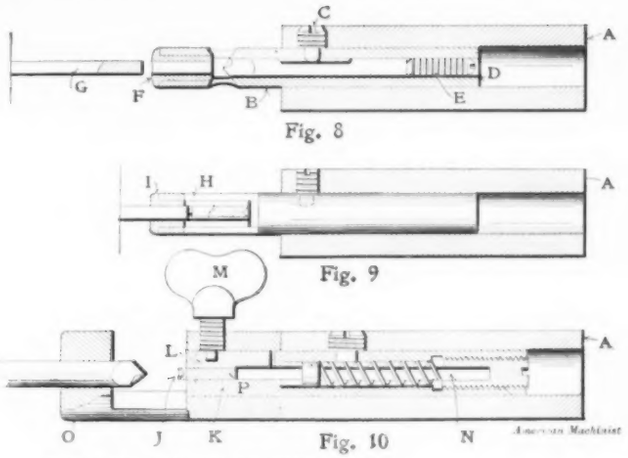
These tools are not presented as a final or best plan for such work when made in great quantities, when a two-spindle drill would be better. But they show how the turret lathe can be utilized as occasion demands.

The principle above illustrated is further carried out in Figs. 12 to 17, which show its adaptation to bench-lathe work. In these figures *A* is to be held in the chuck in the lathe tailstock spindle, for a

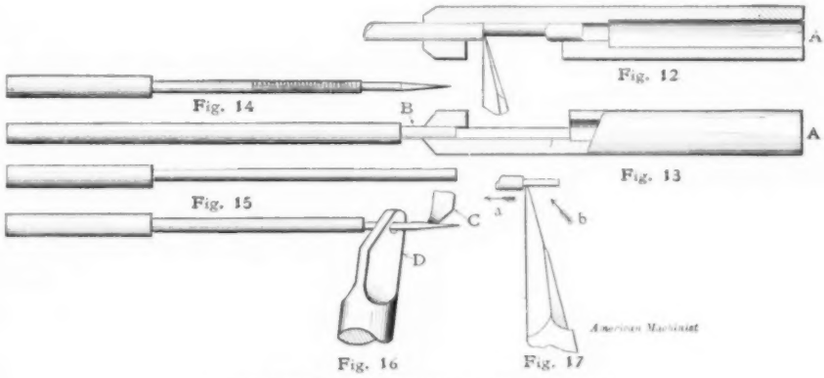
turning rest. A tool shaped as shown is best adapted to turning very delicate shafts, as the pressure of the tool is lengthwise rather than angular, or like *a* instead of *b*, Fig. 17, as with a diamond point tool.

Fig. 14 is a long slender shaft with needle point for electrical work. If the turning is a short one, point the work and use a female center, but in this case turn the ends as at *B*, Fig. 13. Rest them in *A* and turn to the shoulder, as in Fig. 15. If too long, follow up again with *A*, as this maintains the trueness of the turning.

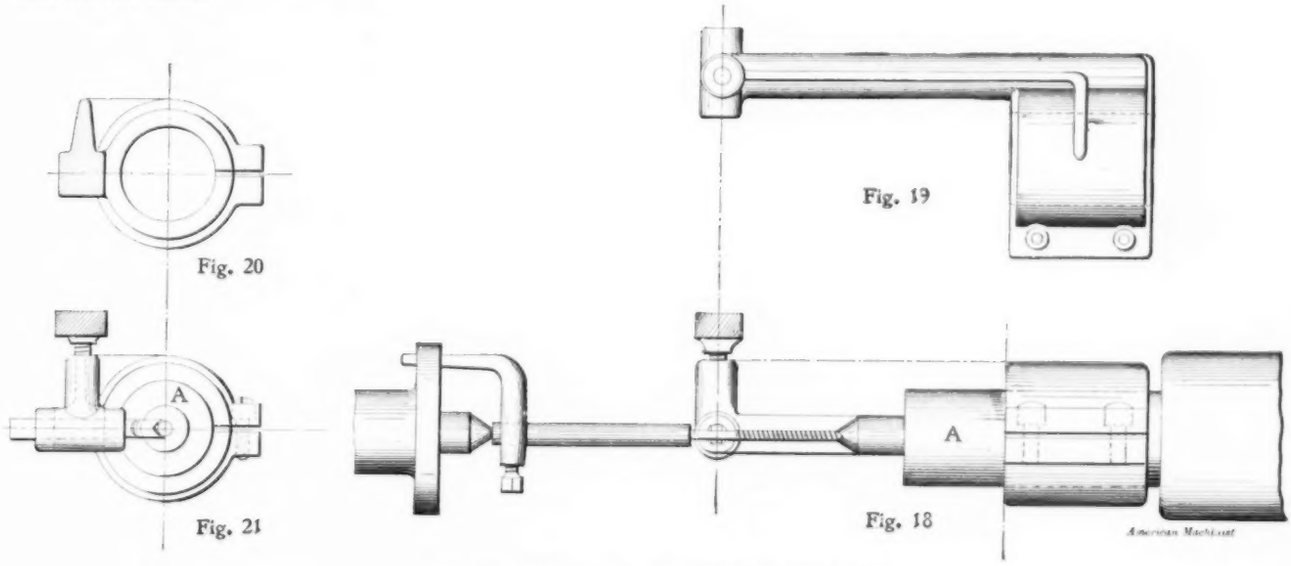
For turning down a tip like that in Fig. 17, use a rest opened less than half way where the cut comes. This locks the piece so that a heavy cut can be made and the size made in one turning. If necessary to make more than one cut to turn the work very small or make more than one shoulder, leave the end full size, as in Fig. 12, and cut off afterwards. This rests the work at each end of the small diameter and when the same cannot be caught easily in a chuck in the lathe at that point. For pointing with the emery wheel *C*, Fig. 16, rest the work in a little metal piece with eye-hole *D* held in the hand. There is nothing better unless a positive angle is wanted, when a close-fitting sleeve held in the three clamp back rest can be used for a guide rest. Along this line a turning and thread-cutting rest seen in Figs. 18 to 21, requires hardly any explanation. The rest slides to place on the lathe tailstock spindle *A*, Figs. 18-21, where it is clamped with the two screws.



TOOLS FOR COUNTER-SINKING RIVETS.



TOOLS FOR SMALL TURNING AND POINTING.



REST FOR THREADING SMALL WORK IN THE LATHE.

A GRADUATING TOOL.

Fig. 22 is a graduating tool used on the milling-machine arbor. The spindle *C* is lifted and held off from the work by the pin being placed in *B* instead of *A*.

A DIE HOLDER.

In Fig. 23 I show a design for a die holder for threading work on lathe centers with the round dies in general use. The work *A*, Fig. 23, is seen in the collet or split chuck ready to be threaded with the die *B* held in the solid collet *C* made in sizes of the different dies. In the knurled hollow handle *E* the inside spindle *D* slides, compressing the long spring *F*, as shown, when ready to start. Then, as the die goes on to the work, the spring holds D back to the center *G* and threads the work straight.

In Fig. 24 I have shown another method used in one of the shops in my circuit. *H* is the lathe tailstock spindle and *I* shows the rear view of the die holder cut open to drop down over the spindle expeditiously. But this holder can be used with only one-sized spindle.

Letters from Practical Men

Ancient and Modern Engineering.

Editor American Machinist:

If I had been living in Egypt at the right time and in the neighborhood where the pyramids were being built, or where they were cutting out and dragging across

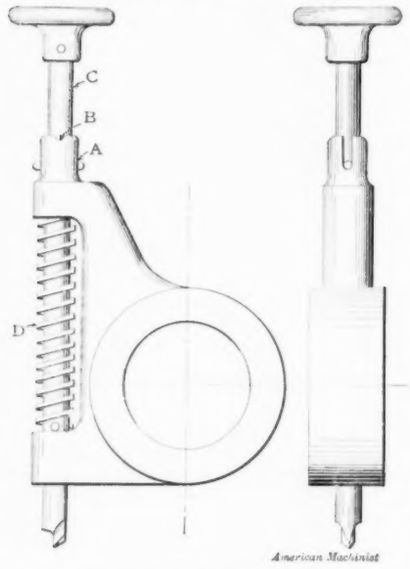


FIG. 22. GRADUATING TOOL FOR THE MILLING MACHINE ARBOR.

the country and setting up on end the obelisks, I think it is quite likely that I would have taken some interest in the work and would have spent more or less of my valuable time in watching the operations. Many of us are still wondering and debating about how those things, and many other of the big things of old, were done, and we probably will never know about it. I do not, however, believe that we of the now would learn anything by knowing more completely the ways of the old workers. The good that was in their schemes was all sifted out as the world worked along, and the rest of it was properly dropped and forgotten, and that's why we don't know more about it. I am very completely assured, for myself, that we are doing bigger things to-day in engineering, and it is worth our while to keep our eyes on these things, and it will do us more good to talk about them a little than to be whining about the lost arts.

I have an idea that the city of New York should be at the present time about the most interesting spot in the world to the engineer. New York is not a city that is built, but one that is being built, and the building of the more or less permanent city is not so much, as of old, the work of the bricklayer and the stonemason as it is that of the engineer, and all the resources of the fully equipped engineer here find full employment. The modern citadels in which are the headquarters of the trusts and syndicates are not mere piles of brick or of stone set upon the ground; they are structures of steel whose foundations are sunk to the solid rock. The greatest of our works, however, are still for the use of the common people. The bridges and the subway are for the masses, who are still the life of the city and the nation. Over these morning and night must unceasingly flow and ebb again the ever-swelling tide of humanity without which the metropolis is nothing.

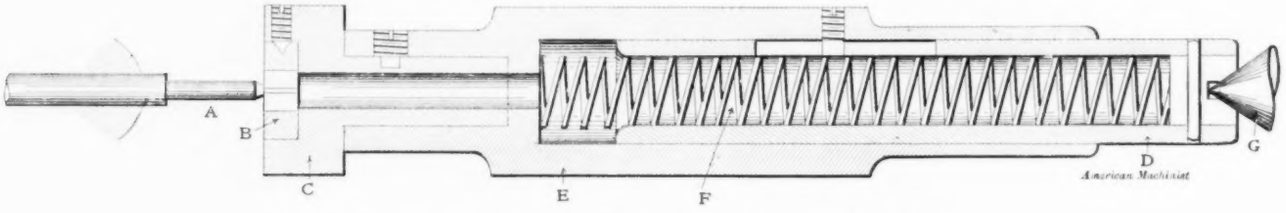


FIG. 23. DIE HOLDER FOR THREADING WORK IN THE LATHE.

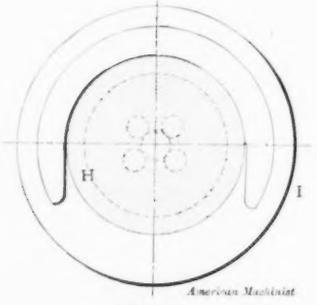


FIG. 24.

The rapid transit subway is of special interest in its construction, not so much because of the magnitude of the work as a whole, or the rapidity with which it is being carried along, as for the range and variety of the engineering problems involved. We think of New York as a city which is built upon ground that is nearly level, yet the more nearly level rapid transit roadbed must at one or two points be carried upon a viaduct higher than the tops of the surrounding buildings, while in an adjacent section the roadway is a tunnel through the solid rock more than a hundred feet below the surface of the ground. So, now that the work is going on under the different conditions thus suggested there is much to look at and to study as to the how and the why of doing it. The story of it all will be told after it is done, but most of us will be too busy to read it.

The work of construction has to be all carried on with as little as possible interference with the regular currents of human activity, disturbance of existing conditions or displacement of other already installed and necessary agencies. The way runs for considerable distances under the busiest of the streets, through which pour constantly hurrying throngs of pedestrians, horse-drawn vehicles with heavy loads and lighter ones for pleasure or convenience, the restless automobile, cable cars, sub-trolley cars and the primitive horse car, and none of these are stopped. Under the ground are sewers, pipes for water, gas or steam and electric conduits. Most of these are mapped and can be planned for beforehand, some are mapped incorrectly and of others there is no record, but they must all be respected alike. The usual task is to hold them up while the roadway is built and enclosed under them and it then becomes their permanent support. Pipes and sewers have to be raised or lowered without interfering with their functions. Water and gas pipes may sometimes be shut off, but not always, but the flow of large sewers can never be stopped, so the work goes on with full recognition of the fact.

One of the most interesting operations to me is the building of the road directly under the two parallel lines of the underground trolley road. The two tracks, each with its central conduit extending a yard below it, are held absolutely in place, and the traffic is not in the least interrupted or interfered with, while the subway is carried along for several miles directly under it. This delicate work is done by the use of bridge trusses parallel with the tracks, one on each side of each track, from which suspension rods are carried down, with a sufficient number of cross-beams under the tracks to hold them rigidly and securely. The portion of the subway somewhat less than the length of the bridge trusses is then excavated and its bed is leveled and concreted. Steel uprights are erected with steel cross-beams and concrete arches between them, the space between the top of this and the under side of the suspended tracks is carefully filled solid, thus forming a permanent support for the tracks and for the entire street surface, when the trusses are moved along another length, and so on. Several lengths of these trusses, of course never adjoining each other, are in use at the same time, so that rapid progress can be made with this portion of the work. Other parts of the job present features entirely different from this, and not less interesting, but it will not do for me to go into

them here. I would be ashamed of myself as a mechanic, however, if I was not much interested in them.

There are two points especially noticeable about the work. One is the amount of office work that has been done. This means that there will be no false moves; no mistakes will be made and no time is wasted. The draftsman pays here just as he does in the machine shop. This job of road building has been laid out, and the execution of every detail has been considered as carefully and completely as if a pumping engine or an armored cruiser was being built, and it pays on this job as well as on any other. The workers have no planning to do and there is nothing for them to wait for when their work is in progress.

The other thing most noticeable to me about the job is the extensive or almost entire employment of mechanical power instead of human muscle. A large portion of this work would have been wheelbarrow work only a quarter of a century ago, but here the wheelbarrow is scarcely seen. Hoisting engines and conveyors have taken the work away from the men, indeed, but they have made possible and profitable the execution of many works which but for them could not have been undertaken. The rock drill and the stone crusher also have robbed men of work to make work for them in this line. The air compressor cuts quite a figure in this work. It not only provides for the conveyance and application of the power to the point where it can be most advantageously used, but it does it in the way that involves the least objectionable features. Much of the work done by it could be here done by steam, but not without nuisance and inconvenience.

There is one other curious and rather astonishing circumstance about this job that ought to be alluded to. I take a little spiteful pleasure in just mentioning it. Electricity has been putting on so many airs of late, and has been bragging so much about what a variety of work she can turn her hand to, that we have been thinking almost that nothing can be done without her. Well, it is a kind of relief to know that there is still a thing or two that she can't do. Here is one of the biggest kind of jobs, with, as we have seen, the widest possible range of work to be done, and she hasn't a hand in it at all. She furnishes light, of course; holds the candle to the other agencies that do the hard work, and she is permitted to use one little finger to fire the blasting batteries where the rock cutting is done, and that's all. When everything is complete, however, electricity will show us what she can do, and everybody knows she will do it all right. She will be bragging again then that all the others have been merely getting things ready for her, and there will be more or less truth in it.

TECUMSEH SWIFT.

Repairing a Hydraulic Press.

Editor American Machinist:

One of the most useful tools in a large railroad shop is the hydraulic press. It is in almost constant use, removing or putting in crank pins or axles. To get along without one, even for a few days, would seem as impossible as to do without a traveling crane. During a busy time in our shop last fall, the hydraulic press broke down. A fracture suddenly appeared on the under surface (see Fig. 1), rendering the press practically useless. A band of iron was shrunk over the fracture, and copper strips were caulked in; but the water then came trickling out of the release port. Stopping up the release simply caused the leak to appear around the bushing at *A*. It was quite evident that the fracture extended into the release. The press was of a standard make, and had been in constant use about eighteen months. The fracture must have been due to a defect in the casting, which had not earlier been apparent.

Although steps were taken at once to secure a duplicate casting, the consequent delay would have been a serious handicap against turning out the usual number of locomotives. It was therefore of the utmost importance that at least a temporary repair should be made. Owing to the length of the bore, it was practically impossible to stop up the fracture from the inside, and attempts at repairs on the outside of the cylinder had proven quite ineffectual.

After considering several plans that were suggested, Foreman Ramwell decided upon the method shown by Fig. 2, which afterwards proved to be highly successful. The iron bushing, in connection with the leather washers prevented any leakage into the space containing the fracture; but there was still danger of the head giving away under high pressure. To guard against this, an iron band, 1 inch thick, was placed across the end of the cylinder. The band was hammered into exact shape by applying it while hot, and was then removed to have a number of 1-inch holes drilled and countersunk. It was again heated and placed in its former position, and the location of the holes was scratched on the cylinder. The cylinder was now drilled and tapped for 1-inch studs, and when the band was again applied while hot, it was shrunk on tight enough to overcome all danger of the cylinder head bursting.

It will be noticed that the iron bushing covered the admission port as well as the ports for the gage and the safety valve. A new admission port was drilled ahead of its original position, and the gage applied to the pipe fittings. The safety valve was left covered, as care would be taken not to run the pressure above the gage limit of 200 tons.

This press afterwards saw two months of continuous service on refractory crank pins and axles before it was replaced by a new one, and although pressure was applied up to 180 tons on the 9-inch ram, it never showed signs of leaking, and it did its work as satisfactorily as if it had never been fractured.

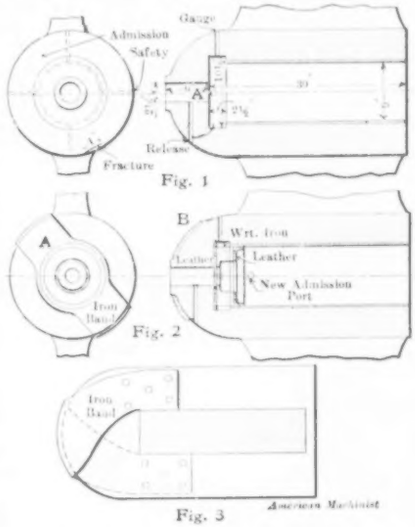
E. K. WENNERLUND.

Oelwein, Iowa.

A Use for the Double Pawl.

Editor American Machinist:

I recently made an application of the double pawl which was new in our shop and may prove useful to some of your readers. A ratchet and chain feed was used in connection with a locomotive wheel tire turning lathe. After running on the road these tires sometimes get harder than when new. For such tires a sufficiently fine feed could not be had, and the turner would disconsolately feed by hand until he got over the hard place.



REPAIRING A HYDRAULIC PRESS.

This brought to my mind an arrangement I once saw on the capstan of an ocean liner, and I took out the pawl and cut off one side of it to allow a second pawl to go beside it, this second pawl being half a tooth longer than the first one. It may be against the constitution of the "American Machinist" to show how to make finer feeds, but in this case it certainly helped us out of a difficulty.

APPRENTICE.

Canada.

A Link Planing Fixture.

Editor American Machinist:

The attachment described below is the design of one of a well-known firm of marine engine builders, who desires to have his name not mentioned, and is used for planing links, link blocks and quadrants. The range of curve obtainable is from 0 to about 12 inches radius.

Anyone who has ever tried to make links by hand and knows how much time, trouble and hard work it takes to get them just about good enough, will, I am sure,

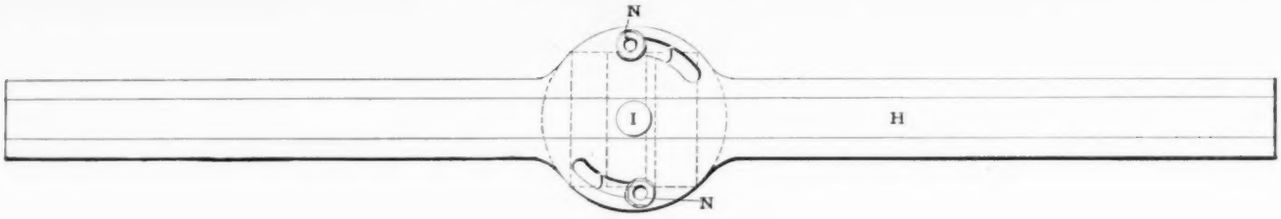


Fig. 1

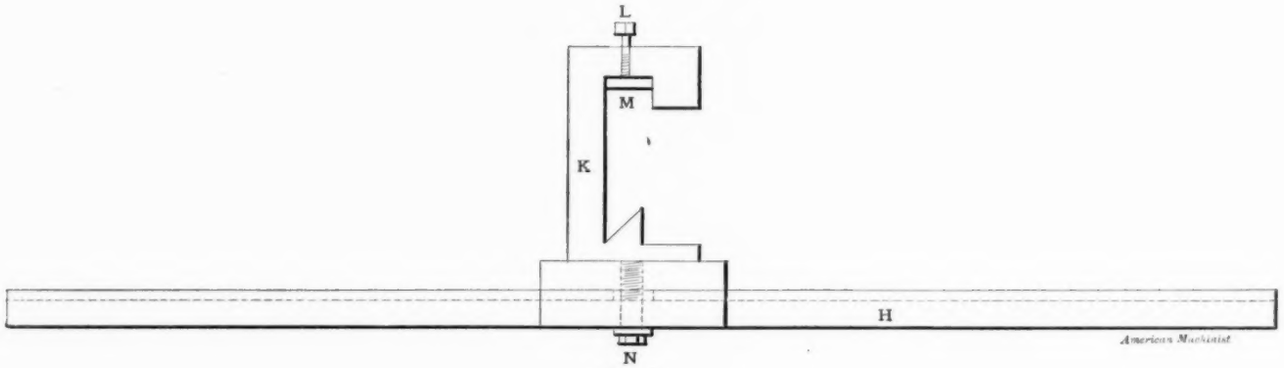


Fig. 2

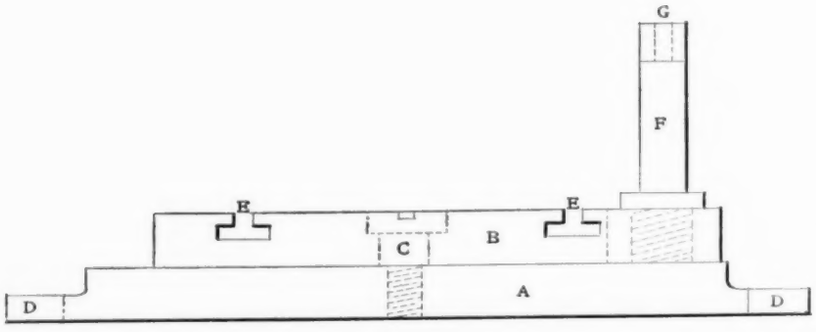


Fig. 3

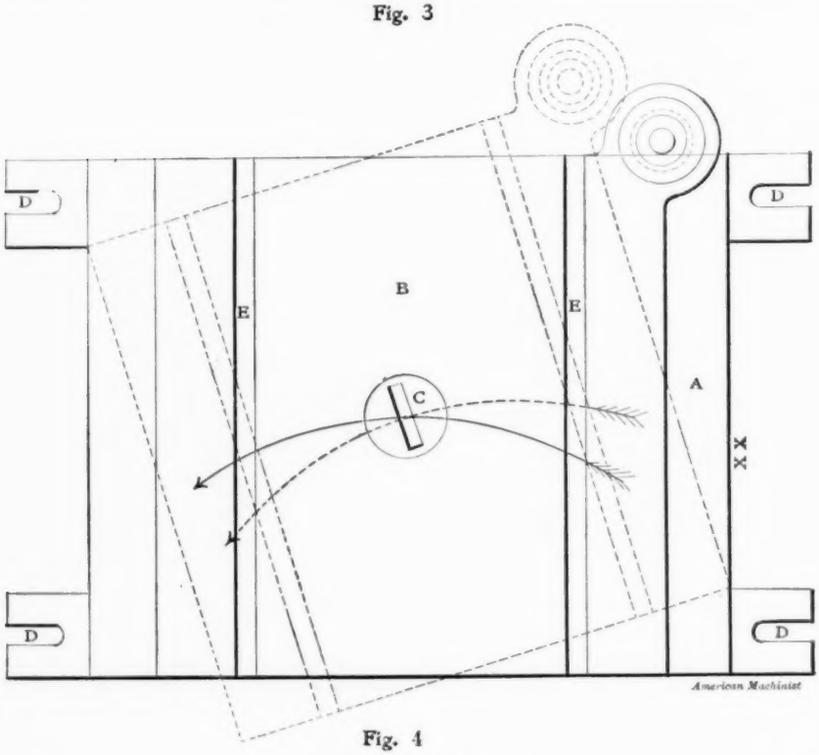


Fig. 4

A LINK PLANING FIXTURE.

appreciate this simple device, by which they can be made exact without having to touch a file to them.

The drawing shows the device pretty completely, but a few of the parts and the setting may be described, to make it perfectly clear.

The part *A*, Figs. 3 and 4, is bolted to the planer platen by the lugs *D D D D* with bolts just long enough to clear, and prevent a wrench or anything from getting accidentally jammed between them and the movable plate *B*, in which case some of the patterns would probably take a trip to the foundry.

Fig. 3 shows *B* held to *A* by the screw stud *C*, which must, in order to get a perfect curve and avoid chattering cuts, be a nice fit, as well as the roller *G* on the stud *F* and in the groove *H*, Figs. 1 and 2, in which the roller travels.

B has also the two T-slots *E E*, which are arranged, as shown in Figs. 3 and 4, to permit the clamping bolts to be adjusted to the varying widths of work to be held.

Figs. 1 and 2 I think need no further explanation than that when the clamp *K* is on the planer cross-rail, the slots *J J* are so placed as to permit the grooved rail to be moved out, and not in and over the work, which would of course bring it in the way and also make the curve in the opposite direction from that shown by the arrows in Fig. 4.

In setting bolt *A* to the platen with the end marked *X X* to the rear, bring *B* parallel with *A*, and the stud *C* (which is the center) about central with the tool-holder. This will, when the parts shown in Figs. 1 and 2 are put to the left on the cross-rail and the groove *H* is lowered over the roller *G*, make the plate *B* swing equally both ways.

Set the work to be planed central on *B*,

both in length and width, and try the curve. If more is required, loosen the cap screws *N N* that hold the grooved rail and the set-screws *L* that hold the clamp *K*, and move in towards the center of the cross-rail; and if less, move it out or to the left.

It would no doubt be well to put a web on the bottom of *A* to fit in the planer slot, and graduate the base of the clamp *K* to aid in setting more quickly, and without trying. NICHOLAS B. MILLER.

Chicago, Ill.

Cheap Jigs—Circular Milling on a Drill Press—Proportions of Lugs.

Editor American Machinist:

In a job shop it is sometimes advisable to make jigs, but usually they must be cheap. I have found that cheap and satisfactory jigs or templets can be made that answer for a short time, and the more one uses such jigs the stronger the habit becomes. Take, for example, a lot of wrought-iron bands shaped like the hoop on a wooden pail and about as large, the iron being ¼x1½ inches and to be drilled for four rivets equally spaced. As the hoops were forged and rounded on the smith's stake, of course no great accuracy in spacing the rivets would be required.

In Fig. 1 we have *A*, a piece of ½x2 inch bar, bent Z-shape so that when the band is hung on it the part to be drilled is level. A piece of bar iron about ¼x1½ inches, bent as in Fig. 3, is riveted to *A* as shown more plainly in Fig. 2, and at the top of *A* piece *C* is riveted and a hole *D* drilled to guide the drill, the walls of the hole being case-hardened. One band was laid off, drilled and slipped on the jig and hole *E* drilled in the jig. After that the bands were simply slipped on the jig, a hole drilled, the ring turned till the hole came in line with hole *E*, when a pin was stuck into it and the second hole drilled, and so on with the others, cheap and good and accurate enough for the purpose.

Suppose there are a lot of rectangular flanged plates, all four sides to be bolted together by bolts through the flanges with planed joints and holes drilled 1-16 over size. If the plates are all the same size I make a solid gage, like Fig. 6, of half-inch square iron, the ends being turned back on the bar and planed out parallel at points indicated. Let me remark, parenthetically, that if there are a large and varied assortment of sizes of such plates and they must, when bolted up, come to a common level, it is imperative that the dimensions be adhered to *accurately* or, say, within half a thousandth of an inch. I have frequently had these planed to a micrometer, for it takes no longer and is much more satisfactory. Now for drilling the flanges lay out and drill the holes in one plate. Take a piece of flat iron, say ⅝x3 inches and about 1½ inches longer than the plate and drill four guide pin holes (as shown by the small circles in Fig. 4). Drive in four pins of ½-inch round rough iron, allowing them to stick out on each side about ⅜ inch. They may be filed a little at *A* to make the jig fit properly if necessary. Now, place the jig on the drilled casting, scribe the holes for the bolts, drill them and case-harden

Fig. 1

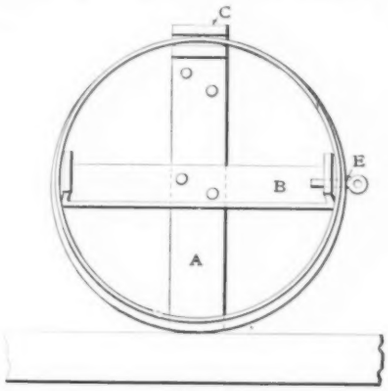


Fig. 2

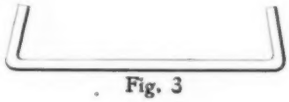


Fig. 3

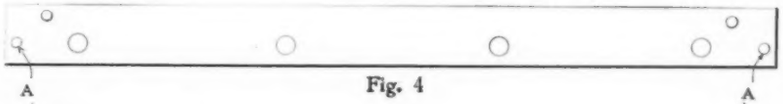


Fig. 4

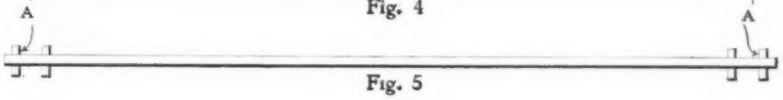


Fig. 5

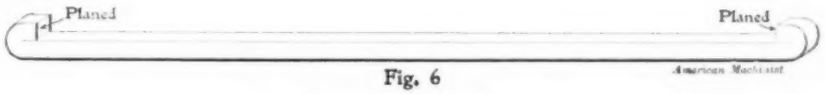


Fig. 6

CHEAP DRILL JIGS.

holes, but they must match perfectly just the same.

I use these tools a great deal. On one job, in which there were about twelve thousand holes from ½ inch to 1¼ inches diameter, I doubt very much if fifty of the holes had to be reamed when the work was assembled and the rest came so fair

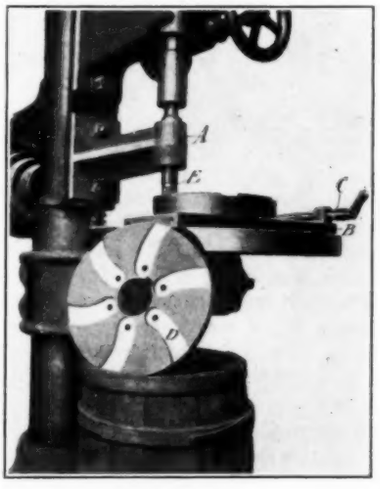
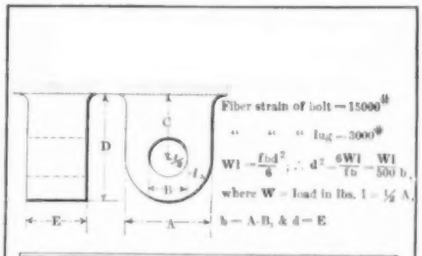


FIG. 7. CIRCULAR MILLING ON A DRILL PRESS.

around the holes. The object of having the pins stick through on *both sides* is so the jig need not, and in fact it *should not be reversed*, no particular accuracy being usually required in the spacing of the



Diam. of Bolt	Load in lbs.	A	B	C	D	E
½	1800	1 1/16	⅝	¾	1 5/32	1¼
⅝	3030	1⅛	¾	1 1/16	1 5/16	2⅛
¾	4530	2⅛	⅞	1⅛	2 1/16	2¼
⅞	6300	2⅝	1	1 1/16	2 11/16	3¼
1	8250	2⅞	1⅛	1 11/16	3⅛	3⅝
1⅛	10410	3⅛	1¼	1⅛	3⅛	4⅛
1¼	13400	3⅜	1⅜	2⅛	3 13/16	4⅝
1⅜	15800	3⅞	1½	2¼	4 5/16	5⅛
1½	19400	4¼	1⅝	2½	4⅝	5⅝
1⅝	23000	4⅝	1⅞	2⅝	5 1/16	6⅛
1⅞	26000	5	2	2⅞	5⅝	6⅝
1⅛	31000	5⅜	2⅛	3	5 11/16	7⅛
2	35000	5⅞	2¼	3⅛	6	7⅝
2⅛	40000	5⅞	2⅜	3⅛	6	8⅛
2¼	45000	6	2½	3⅛	6⅛	3⅛
2⅜	50500	6	2⅝	3⅛	6⅛	9⅛
2½	56000	6½	2⅞	3½	6⅞	10

CAST IRON LUGS FOR BOLTS.

F. L. B. '97

American Machinist

that the bolts could be slipped in with the fingers and in no case were the holes more than 1-16 inch over size—*i. e.*, 1 5-16 inch holes for 1¼ inch bolts. The secret was that within narrow limits no deviation from figured dimensions was permitted and the jigs were made so that they need not be reversed. No hardened bushings were used, the templets being only case-hardened around the holes.

I show in Fig. 7 a job of circular milling being done on a drill press. The part *A* is a substantial cast-iron arm bolted to the drill-press column and bored in position. A cutter spindle *E* is carefully fitted to this arm and is driven by the drill spindle, while a collar on *E* above the arm prevents the cutter from cutting too deep and the feed mechanism of the drill holds the cutter into the cut and takes up the back lash. The cutter is shown just coming out of the cut which was started from the inner end of the slot. The piece to be milled, of which *D* is a sample, is clamped to a plate *B* which turns on a stud in the drill-press table and is operated by feed-screw *C*. The indexing was done by drilling one plate, as shown in piece marked *D*, and then counterboring to the proper depth. Then the disks were dropped on a stud on plate *B* and turned till the milling cutter would enter the counterbore, then clamped and a cut started. No accurate spacing was required. The slots were about 5-16 inch deep by 1½ inches wide, the disks about 12 inches diameter.

The table of proportions of lugs for bolts may be handy—I have found it so. The dangerous section was assumed to be at the center of the hole instead of at the root of the lug. This may have been a wrong assumption, but if so it is of little consequence, because if it is assumed that the load is applied at the center of the hole and it gives almost precisely the same result. Whether the formulas for a cantilever are applicable here or not, I am by no means certain, but, be that as it may, they look all right, and one might believe the bolt would break rather than the lug, which it should. That is the reason for assuming such a high fiber strain for the bolt. The calculations have been very carefully checked.

A. L. Bowen.

Rig for Truing Crank-shaft and Crank-pin.

Editor American Machinist:

I send you sketches of two devices which we find of service. Fig. 1 is for correcting the surface of a crank-pin when after years of use it is worn out of shape. The hollow cylindrical shell *A*, accurately bored and faced, is bolted to the face of the crank. The second hollow cylinder *B* is turned to fit *A*, and at its inner end is fastened the cutting tool *D*. Handles *M*, *N* are fastened to the outer end of *B* by which to turn it, the work being done by hand. At one side of *B* is a longitudinal channel or groove for the feed-screw *C*, with room enough for the nut *G* to travel. The screw, nut and star-wheel *F* all travel around with *B*, but a lip at the side of the nut *G* constantly projects into the annular groove *H* in the outer cylinder *A*. The stationary rod *E* for operating the star-wheel is screwed into the center of the crank-pin and offset as shown to reach the star-wheel.

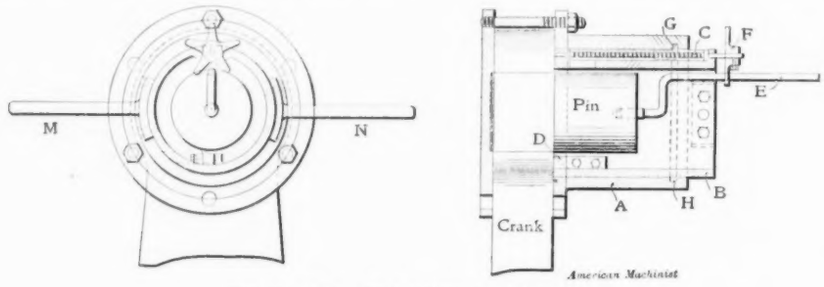


FIG. 1. RIG FOR TRUING CRANK PINS.

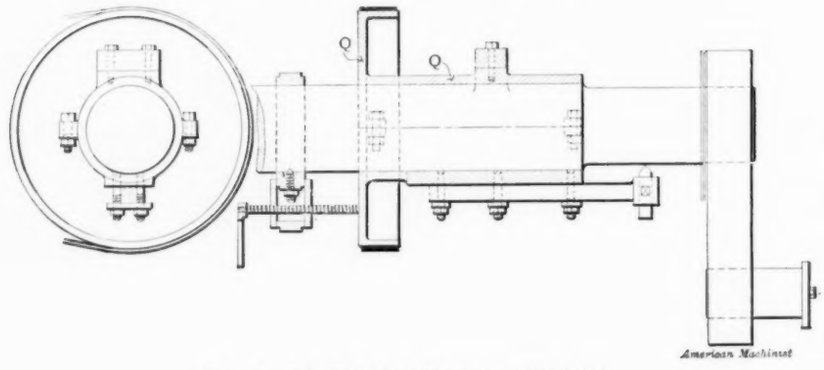


FIG. 2. RIG FOR CRANK-SHAFT JOURNALS.

When a crank-shaft journal is worn and requires truing we use the apparatus shown in Fig. 2. The sleeve *Q*, made in halves, is fitted to turn on the body of the shaft as shown. The tool, of the required length, is bolted to one side of the sleeve, and the piece bolted on the opposite side serves as a counterbalance. The pulley is an integral part of the sleeve, and the power is taken from a hand-operated windlass or from any available source. The eccentric of the engine is made use of for feeding. A nut is clamped to the projecting side of the eccentric and the feed-screw is worked with a wrench. When the apparatus is set the work is quickly and accurately done.

A. Bollinckx.

Brussels, Belgium.

Criticism of a Pattern Shop.

Editor American Machinist:

On page 561 you print a good interior view of a German pattern shop, and as it is supposed to be a modern shop, I feel called upon to point out a few sins of omission and commission. In the left middle distance and in the foreground are two band-saws, small of wheel, wide of blade and scant of clearance—the three worst possible conditions to handicap a machine with. A scroll saw is apparently not included in this outfit, and it is true that they are not much used, but when you want to do any "inside" work, you want one bad, as this German company with the unpronounceable name has doubtless found ere this.

Hanging close to the wall on the left are a few hand screws, and, judging by appearances, the benches are pretty much occupied, which leads one to believe that there must be some great scrambling for hand screws when there's lots of gluing up to be done, but perhaps there are more in that "toolroom," a handy place to keep them when a fellow wants an odd one or two to clamp a joint that will not close.

Prominent in the right foreground is that ancient and honorable, odoriferous and remarkable glue pot, and far be it from me to write one word that would injure its "Barren Island" reputation, but the up-to-date shops do not use this type of pot, but one with a double bottom and sides, with a space between; all of which is placed in the boiler. The beauty of this pot is that it does not burn the glue, neither does the glue "cake" at the sides or become cold for a long time after removal from the boiler, which cannot be said of the "Werkzeugmaschinen" glue-pot.

I notice also an almost entire absence of workboards, though a great profusion of "horses" are in evidence (apparently of the thoroughbred "selling plater" class, judging by their rather lean limbs, set at a rakish angle), and while they probably do things differently over there, it is a fact that our modern shops try to provide at least one workboard per man.

These things, Mr. Editor, I noticed in

a rather hurried examination of your halftone; otherwise it appears to be a shop with a fair equipment, but nothing to brag of. "Old Bob."

Tapping Castings for Large Pipe.

Editor American Machinist:

I once had quite a large number of holes to tap for 6-inch pipe. These were in a diaphragm or rather in two diaphragms, one above the other, and they were situated substantially as shown in section in Fig. 2. The casting weighed about 8 tons, and the spoiling of one of those holes would not have been regarded as a joke. My first idea was to make a tap and tap them, the same as one might with small sizes of pipe, but after experimenting a little with plates bored to the same size I found it impracticable with the facilities I then had. The holes were bored with a boring bar in a radial drill, which is a simple enough thing to do, but there was one feature of the rig that I wish to speak of.

In Fig. 1 is shown a portion of a boring bar with a fixed head having four cutters. This head, being fixed on the bar, was fed down by the drill press feed gear. Now, on the lower side of the bottom diaphragm, was a strap *A*, shown in section, secured by bolting through any hole or holes that permitted, and this strap had a cylindrical hole near the center. A taper bush neatly fitting the boring bar completed this arrangement, the beautiful feature of it being the taper bush, which gave a kind of universal adjustment that was always tight. Going back to Fig. 2, we have a boring bar attached to the drill spindle by a split coupling. The holes are all bored out and we are going to tap them. The lower end of the bar is bored and tapped for a 1-inch screw 6 or 8 inches long, shown at *C*, held securely down and kept from moving by clamp *D* and jackscrew *E*. A taper bush *F* affords a ready means of setting the boring bar without measuring, the bushing or head *G* fixing the upper end. This is shown better in Figs. 3 and 4. It should be a nice running fit in the hole to be tapped, and held on the boring bar by a key dovetailed in. A piece of tool steel *H* about ¾ inch square is held by a set-screw and is chased 8 threads per inch. Made thus it may be sharpened by grinding on the face and as the hole goes through to the shaft, the cutter may abut against the shaft also, and so there is no trouble about maintaining the size.

With the bar in position, let the head *G* drop down until the cutter *H* touches the diaphragm. An ordinary set-collar (not shown) follows it and is tightened in position. The drill press feeds are thrown out and the machine is ready to start. I tried to thread two holes at once, but the driller was not powerful enough to do it. The threads were finished with a taper tap, which fitted the same or a similar bar, using a bush in one hole to insure alinement of the threads.

This tap is shown in Figs. 5 and 6. The body was made of machinery steel, the teeth being dovetailed in and held in position by cover plates secured by countersunk screws. I have given the dimensions on the sketch because the tap was perfectly satisfactory and someone might like to know the exact proportions of the

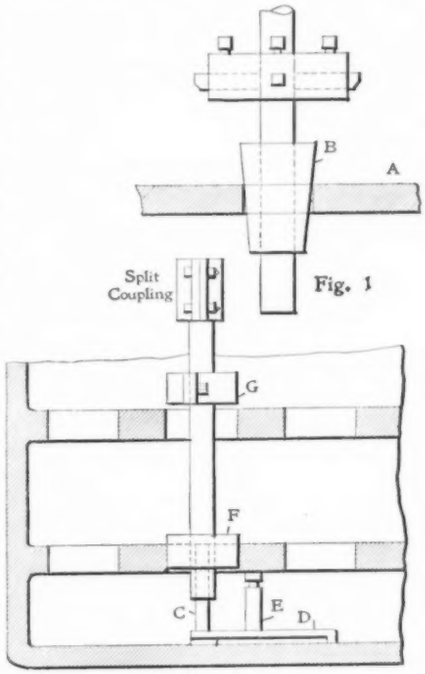


Fig. 1

Fig. 2

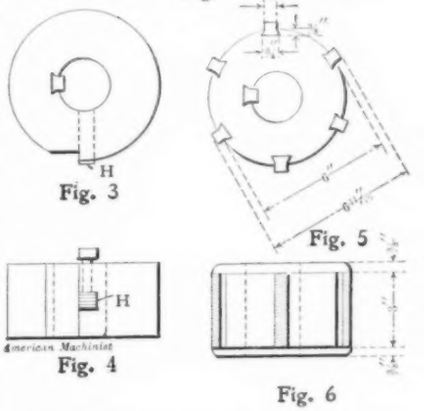


Fig. 3

Fig. 4

Fig. 5

Fig. 6

BORING AND TAPPING CASTINGS FOR LARGE PIPE.

various members. There is one point I wish to call attention to, and that is that the cutters are very apt to come out a little bit long in tempering, and I found it necessary to put the tap on a mandrel and gear up the lathe with a thread tool, just as though going to cut the threads, and then rap the cutters one way or the other till they came just right. Then the projecting ends were ground flush and the cover plates put on. The cutters were carefully relieved by hand.

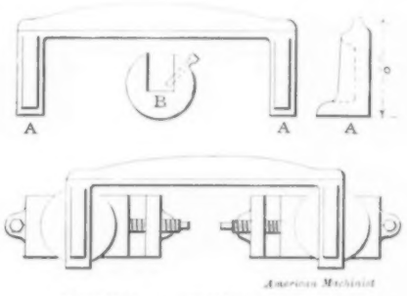
A. L. Bowen.

Holding a Springy Casting.

Editor American Machinist:

The device shown in the sketch enabled a boy on a milling machine to turn out several times as much work, and to do it better than a machinist had been able to do on a planer. There were several operations to be performed on a piece of the shape shown, but first of all it was necessary to face the two surfaces *A*, so that when they were placed on a surface plate there would be no "rock," and as the piece was very light, and generally warped besides, some difficulty was experienced in holding it until the method here shown was adopted.

Two balls *B* were cast and turned. There was a slot in each and the two ends of the piece went in these slots, being held there by the set-screws shown. Two milling machine vises were used with jaws cupped out to the same radius as the balls. One vise was permanently fastened to the platen of the machine, and one ball, with the casting of course, was fastened in this vise so as to be free to move in every direction, forming in fact a ball and socket joint. The casting was then swung around



HOLDING A SPRINGY CASTING.

on this ball as a pivot until the other ball came within the jaws of the other vise, which was loose on the platen. After the second ball was fastened in this vise, the vise was clamped to the platen and the piece was held as shown. None of these operations sprung the work, and yet it was held securely. It took very little time to chuck a piece. The work, when finished, was true, and a boy could do it.

T. A. B.

Neglected Tools.

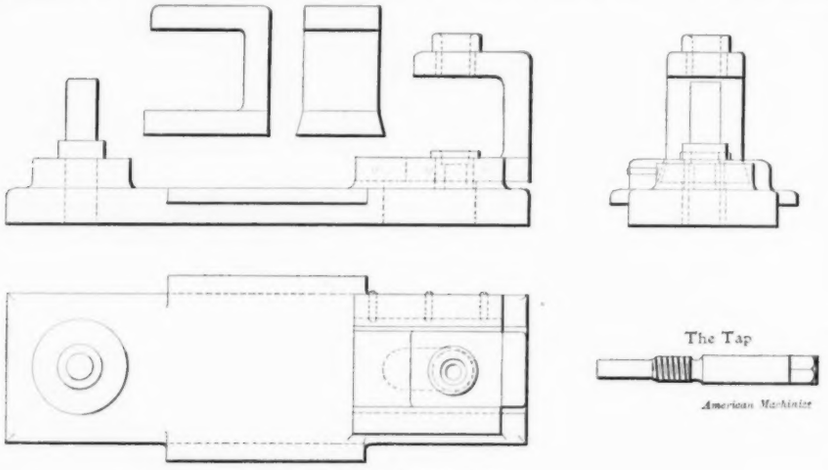
Editor American Machinist:

Your cuts on pages 256 and 369, showing how the ellipse is derived from a section of a cylinder, might be taken just as they are for illustrating something entirely different. They represent two tools which deserve to be better known. A round drill rod, ground with an oblique end, as shown in the cut referred to, makes a very satisfactory power reamer for small sizes. The second use of the same is as a hand turning tool or scraper, much superior to a flat end. It is proper to call attention to these tools because of their merit and rarity. H. W. Pond.

A Jig for Tapping Bicycle Cranks.

Editor American Machinist:

While in charge of the manufacturing department of a certain bicycle firm, I designed and had made the jig here shown for tapping the pedal pin-hole square with the crank. It saved much time and did the work. Of course other tools were made to drill and face the pedal hole before tapping. The cranks were 7 and 7½ inches from center to center and offset ⅛ inch. The yoke carrying the bushings to guide the tap was free to move back or forward to suit the length of the crank. The crank was placed on the pin at the left and then swung into place, resting on the lower bushing in the yoke. The bushings were ground and lapped to suit the respective diameters of the tap, the pilot of which



A CRANK TAPPING JIG.

was the size of the hole in the crank and also the bushing, which kept it in perfect position until finished. The fixture was held in a bench vise, resting on the jaws on the lugs as shown. A. M.

The Points of Set-Screws.

Editor American Machinist:

There is one subject which to my mind needs ventilation, and that is about set-screws for pulleys and collars on shafting. The set-screws, as made to-day with a cup point, seem to me not the best for the purpose. If the cup is not in the center of the screw it will invariably break when setting it down on the shaft, and even if not broken it cannot be set hard enough to make a firm job. I would have round points on the screws. They will not mark the shaft, they stand no chance of being broken; they can be set much easier to hold the pulley to do the work when hard work is required.

Having gone through quite a long experience among pulleys in a large manufacturing concern, it has been my misfortune to have many pulleys with cup screws, quite a lot driving screw presses. It made considerable work at times to get the pulleys put back in place, when they would turn on the shaft, the small pieces from the lip of the cup point cutting a groove along the shaft, which most of them did when heavy work was done. I took the screws out and ground the cup points off, making round points, and I never had one pulley slip on these presses or any of the machines.

Where I served my time in Scotland set-screws were not allowed in pulleys or collars; we had to make hollow keys to fit the shaft. It cost more, but made a neat job, and no risk of catching the clothing and being twisted round the shaft. I never had any trouble with pulleys coming loose with a hollow key. I fitted up one big job of shafting when the ends for couplings were ¾ inch larger, and the pulleys were bored to go over the large part with tapered bushings cut in three pieces to drive into the pulleys. It made a splendid job. I was there for several years and never had a pulley come loose, so that I claim it is not necessary to have the screws cut into the shaft to make them hold. A screw with a round point will make the pulley have more friction on the shaft. A. SANGSTER.

Lubricant for Drawing Shells.

Editor American Machinist:

Take 2 lbs. opodildock soap, 1 pint common lard oil, 8 gals. of water; steam or heat until warm. Have a square pan attached to the front of the press. Keep the shells well covered. No need to keep it warm unless the shells are small, like primers or pencil tips. I have used this for 25 years and found it better than any other kind.

"NUTMEG."

His Name Changes Again.

Editor American Machinist:

We have read with some interest the article in your issue No. 21, "And by His Teeth Ye Shall Know Him," and also the one in your issue No. 22, "His Teeth Are Variable," and have to say that this same man called to see us.

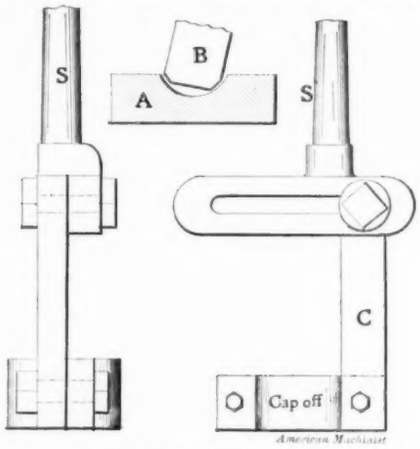
Our experience with him was much the same as those described in the articles referred to. We were not deceived in the man, as we suspected before he left that he was not genuine. He represented himself to be the son of the late Jos. Whitworth, and was inspecting navy yards and buying tools for his firm, Armstrong, Whitworth & Co.

LANDIS TOOL COMPANY.

Boring a Taper Hole in a Big Wheel.

Editor American Machinist:

I lately saw a job that would have interested your readers—boring a taper hole in an 11-foot wheel with a 5-foot radial drill. The wheel was a gear with six arms. The arm of the drill was taken off and the gear was laid flat upon parallel blocks on the drill table, the post of the drill coming between the arms. The arm was replaced



RIG FOR TAPER BORING.

on the drill and the gear was set concentric with the drill spindle and fastened. The stem *S* was placed in the spindle socket, and to its cross-slot was bolted the piece *C*. The lower part of *C* formed a clamp into which was fastened the upper end of a boring bar with a sleeve, feed screw and star-wheel for feed. The lower end of the bar *B* was spherical and rested in a spherical and concentric step *A*. The bar was set to the required taper by means of the slot above, and then the boring was a simple job. C. N. J.

The Open Shop Door and the Visiting British Workmen.

Editor American Machinist:

After reading Mr. Tecumseh Swift's interesting letter on "The Open Shop Door" on page 573, I decided to send you this clipping from the editorial column of a New England daily of recent date. You will observe that after calling attention to the fact that several British mechanics have arrived in this country for the purpose of visiting our shops and investigating our methods, the writer makes some rather peculiar statements regarding the secrecy with which many of our shops are surrounded and the impossibility of

visitors gaining admission to such places. While the greater part of the editorial is all right, and the writer of it certainly gets there when he says that "good living, good wages and recognition make the American workman what he is," it is hard to understand how the editor of a paper published in the heart of the New England machine tool industry can have gained the idea that the doors of so many of our machine shops are tightly closed. He should read Mr. Swift's letter and profit by it. S. F. ARTHUR.

[The following is the principal portion of the editorial above referred to. Ed.]:

"This is an experiment and one in which there is much less than Mr. Cassier imagines for the English manufacturers. In the first place, a great many of the shops are constantly closed against visitors, and portions of them are closed against the workmen themselves. There are thousands of secrets about American methods of manufacture which the manufacturers will not let get away from them at any price.

"Should the Englishmen catch on to American methods in various shops, that does not give them the American spirit. The American spirit is what gives vim to American manufactures and enables the workmen to produce more goods in a limited time than the workmen of any other country. The independent sovereign idea —American manhood—is back of and in everything that is done in this country; and good living, good wages, and recognition make the American workman what he is. What makes the American superior to foreign workmen is the principle foreign governments refuse to recognize. There is something in tools and in system, of course, but the crowning factor is that every man is encouraged in the development of all his abilities and in the exercise of his genius. Oh, no, the British inspecting force cannot get and carry away that which makes American workmen great."

National Association of Manufacturers.

The sixth annual convention of National Association of Manufacturers was held in Detroit last week, the first session being called to order at 11 A. M., on the 4th, by President Theodore C. Search, of Philadelphia. There were first addresses of welcome by Geo. H. Barbour, chairman of the Executive Committee, and by Mayor William C. Maybury, which were enthusiastically received, and after an appropriate reply by President Search he presented his annual report, which was an extended one, taking fifty minutes for its presentation and dealt with Reciprocity, Trade Complications with Russia, Legislative Work, Ship Subsidies, the proposed Department of Commerce and Industries, Improvements in the Consular Service, Parcels Post and other matters of special interest to manufacturers.

On the subject of reciprocity it was made plain that President Search takes advanced ground. He declared that the ratification of reciprocity treaties was of the utmost importance to the manufacturers of the United States and that the new conditions brought about by our foreign trade must be met, saying: "I believe I do not overestimate its importance when I say that the continuance and further extension of our magnificent export trade in manufactured products depends more upon our willingness to barter privileges with our foreign customers than upon any other influence we can discern at the present time. . . . If we are not willing and able to adopt such a policy we must expect, not only the loss of privileges we now enjoy, but also open retaliation as a punishment for our selfishness."

This proved to be what may be called the keynote of the convention. During the discussion of the report, which took place in the afternoon, manufacturer after manufacturer who a few years ago would have been horrified at any proposal to do anything whatever with a tariff law except to make it higher, declared his conviction that if we expect to go on with our foreign trade we must expect to take something in return and must show a willingness to give our foreign customers a chance to bring goods into the country upon something like the same terms upon which we send goods abroad.

Again and again it was declared by speakers that duties might not merely be reduced, but that there was no need of them at all on some lines of manufactures and sugar and steel were especially specified as being articles that needed no protection. W. L. Saunders, of New York, attacked the sugar trust; said it was mainly responsible for the trouble with Russia and that the 2c. per pound higher price which it was enabled to charge American consumers, amounting to $80,000,000 yearly, ought to be left in the pockets of those who are now compelled to pay it. Mr. Laidlaw, of Cincinnati, said that it was evident from what was constantly taking place that the steel company needed no protection upon its product, and altogether the general sentiment of the convention was strongly in favor of "taking a few bricks off our outrageous tariff wall," as one member expressed it, or of knocking a hole in it here and there for the freer admission of goods produced abroad, which we either did not produce at all or which every-day transactions were showing that we did produce more cheaply than they could be produced elsewhere.

Among the many who spoke there was only one dissenting voice, which was that Mr. Osborne, of Philadelphia, who is interested in the knit-goods trade and who declared that that industry could not stand the proposed reduction of 20 per cent. in the tariff rates on his goods, and one of the reasons he gave for it was that they paid 45 per cent. duty on much of the machinery used in the industry, which machinery he said could not be made here, although an effort was now being made to establish its manufacture. Mr. Saunders replied, showing that others engaged in the same line of manufacture had declared that the proposed reduction was only 12½ per cent. and that it could be endured well enough, but that they—the knit-goods manufacturers—"simply proposed to get all they could and keep all they got."

Mr. Barker, of New York, who had had considerable experience in legislative work connected with the effort to enact reciprocity treaties, said that the reciprocity treaty with France had been opposed by the iron interests, because they were to receive no benefit from it, by the machine-tool builders for the same reason, and by manufacturers whose products could be imported, whereupon some tool builders present declared they were not opposed to it, but favored it, and Mr. Smith, of New Jersey, stated that his company had lost an order that would have amounted to $10,000 or $20,000 on account of the Russian difficulty over sugar.

Finally the matter was referred to the Committee on Resolutions with the expectation that it would present a resolution to be adopted by the association favoring vigorous action in favor of reciprocity.

Though the president's report dealt with many other things besides reciprocity that was practically the only feature of it that received attention from the delegates. The subsequent sessions were practically filled with debates upon this subject, or rather with an endorsement of the principle of reciprocity, for there was little real debate upon it until it came to the adoption of resolutions embodying the sentiments of the delegates.

Up to that point it was more in the nature of an experience meeting; one manufacturer after another simply rising to say, in effect that, while he had always been and still was a protectionist, his views upon the matter had undergone a change based upon the logic of events and that he now believed it was of paramount importance that we should do something to advance our trade with foreign nations and that we could not expect to do this without making some concessions to the foreigners who wished to trade with us.

One member declared that as a protectionist he believed protection never had been considered in a businesslike way by Congress and instanced the work of the Oliver Commission, of which James A. Garfield was a member and which carefully and conscientiously went over the whole subject with a view, not to injuring or abating the principle of protection, but of conserving it and strengthening its position by removing some of its inconsistences and modifying some of its excesses. Congress had not only refused to be guided by the conclusions of the commission

but had formulated a new tariff wholly upon political grounds, ignoring the plainest business principles. He thought it was time that the tariff question should receive the consideration of business men, basing their action upon business principles and conditions as we find them today. He had been informed by a member of the convention interested in the manufacture of pressed glassware, that they did not in the least need the duty of 30 per cent. on such ware, but could beat the world in its production. The speaker's own line was hand agricultural implements made of steel. He said they needed no protection whatever.

Mr. Saunders, of New York, who is interested in the manufacture of air compressors, and the bulk of whose product is not protected by patents, said they needed no protection and would prefer to have the tariff taken off their goods. It was a hindrance and an encumbrance to them in doing business abroad.

A manufacturer of ice tools said that he and his firm had always been protectionists on general principles; no tariff was needed on their goods and if the tariff were removed from steel (their principal raw material) they could do still better in foreign markets where ice tools are used.

A manufacturer of shoes gave the same testimony. They were selling large numbers of American shoes abroad, needed no protection whatever against foreign shoes, but wanted the worse than useless duty on hides removed so that they could do still more business abroad and employ still greater numbers of men in shoe manufactories. In discussing this matter members who had evidently given it much attention declared that the duty on hides benefited only four packers, who dictated the markets and made millions out of it at the expense of all wearers of shoes and of the manufacturers of them. A tanner sustained this view also, although the hides he himself used came in free from South America, as they were classed as "skins" instead of hides. He wanted no duty on leather and said that we export ten times as much of it as we import.

Mr. Estey, of Vermont, the great organ manufacturer, said that they needed no protection on their goods, but he believed in protection because he thought it made the masses of the people (wage earners, etc.) better able to buy organs because of their greater prosperity under it. He was replied to by a shoe manufacturer, who declared that if the duty were removed from hides and shoes they could afford to pay better wages than they are now paying and that there would be an increased demand for workmen in the factories.

Another organ builder did not agree with Col. Estey's position and declared that we must have foreign business and must revise our ideas about the tariff.

Mr. Carlisle, connected with the Studebaker Bros. establishment, said that they bothered themselves very little about tariffs and he believed that the American manufacturer was bound to lead in every market of the world because of the natural advantages possessed by him and the superior character of the labor here available. He referred to the report of Lord Roberts, showing that among all the wagons used for transportation by the British army in South Africa (coming as these wagons did from practically all countries where wagons are made) the American (Studebaker) wagons stood the climate and hard usage far the best, although they cost materially less, delivered in South Africa, than any others that were used there.

Mr. Fairbanks, of Vermont, the great weighing scale manufacturer, declared himself to be a lifelong protectionist, but he believed the time had come for a revision of the tariff through reciprocity in such a way as not to disturb business.

Mr. Pike, of New Hampshire, said two-thirds of the product of his firm, the Pike Manufacturing Company, of Pike Station, N. H., was shipped abroad and no protection whatever was needed in their business. They had always been protectionists, but it was his belief that unless this matter was taken hold of and a revision made either by reciprocity or otherwise, the free-trade party would come into power and destroy the whole protective system. "We must," he said, "forestall this."

Oliver Williams, of Pennsylvania, said it was a mistake to suppose the foreign manufacturer was not fully alive and that in his opinion we would do well to keep on guard. In foreign shops he had seen American machinery being used under the direction of American foremen and he believed they would prove efficient competitors.

Mr. Smith, of Indiana, said he was interested in rubber manufacture and needed no protection. He suggested correspondence with manufacturers everywhere to find out what was really needed and what was not.

Mr. Smith, of Detroit, had been, as his firm had been, a protectionist for twenty years. He was now convinced, not only that protection was not now needed, but that they never had needed it. He asked: "How long can we expect to go on exporting and not receive anything in return from our customers abroad?" He believed, moreover, that the farmers should be considered and that if they were not they would be heard from in a most decided way.

Mr. Taylor, of Ohio, thought we had been exporting our tariff laws for a long while and that unless we modified them soon we would have serious retaliatory action by all other countries to which we are now sending our goods. He believed reciprocity was too slow and favored a method which would bring about a modification of our tariff more quickly. He made an impassioned and eloquent speech urging immediate and decided action.

Finally, at the last session, when the question of adopting resolutions came up, the Committee on Resolutions submitted resolutions which were considered by many to be too vague. They recommended a reciprocity convention to be held at a future date not named, and aside from this merely reaffirmed the position taken by the association at previous conventions.

Mr. Barker, of New York, offered resolutions signed by a number of the most prominent delegates making more definite statements and particularly recommending and urging the ratification at the earliest possible date of the pending reciprocity treaty with France.

There was a sharp parliamentary struggle upon this, the Committee on Resolutions endeavoring to shut out the substitute resolutions from consideration and Mr. Barker insisting upon their consideration. During this debate Mr. Osborne, of New York, said that the influence of the textile interests had been the force that had prevented the ratification of the French treaty. He told of the magnitude of these interests and the number of dollars invested in the business and said these interests would prevent any reciprocity action whatever unless they were considered. He warned the association that all their efforts would be futile unless the textile men, especially the knit-goods manufacturers, got what they wanted, which seemed to be the maintenance of the present duties. The committee's resolutions were finally adopted and Mr. Osborne's threats had prevented the association from passing resolutions obviously much more in accordance with the almost universal sentiments of the members, as shown in discussion.

After further discussion the following resolutions were passed:

"Whereas, Recent events have brought forward questions of tariff revision, and

"Whereas, The subject is one of vital interest to the members of this association and is intimately connected with the most important purpose of this association to facilitate the expansion of American trade and commerce at home and abroad;

"Therefore, be it resolved, That the National Association of Manufacturers affirms that the following principles should govern all tariff legislation:

"1. The object of tariff legislation should be to furnish adequate protection to such products only as require it without providing the opportunity for monopoly abuses.

"2. The tariff on goods of which the cost of production is higher in the United States than in foreign countries should be at least what is necessary to compensate domestic industries for the higher cost of production."

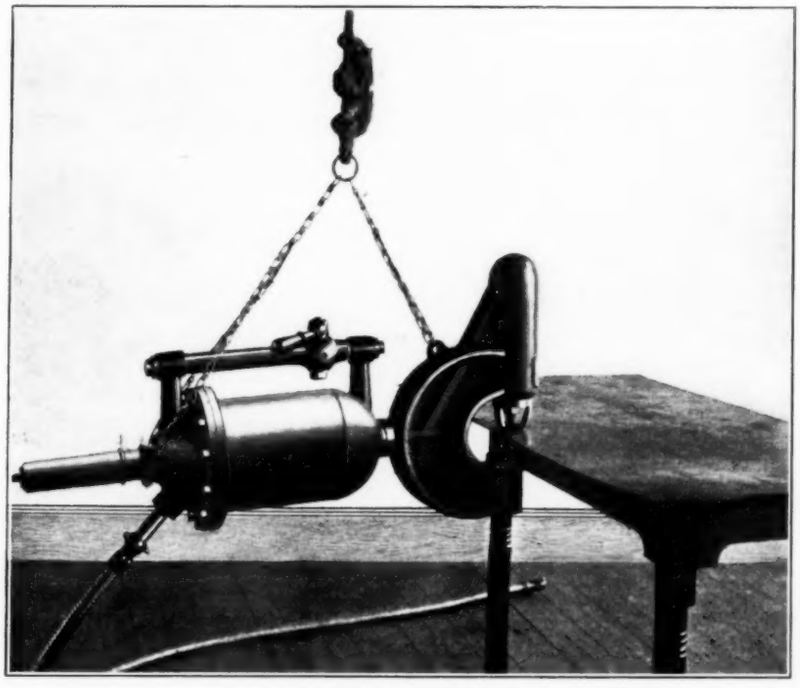
The entertainment provided by the Detroit hosts was generally voted to be of the most pleasant character, and the city acquitted itself very creditably indeed.

A thoroughly deserved recognition of the signal ability of President Search was his re-election by acclamation, and Secretary Wilson and Treasurer Scheiren were also re-elected.

Some New Things.

A PORTABLE PNEUMATIC PUNCH.

The half-tone shows a punch which may be slung in the position shown or in any other as desired, and may be operated by the air supply used for the riveters, calkers and drills. The work to be punched need not be carried to the machine, requiring two or three men to handle it, this punch being carried to the work and easily manipulated by one man. In construction the tool is quite simple, the chief distinctive feature being a hollow piston containing oil, within a prolongation of which piston a stationary tube is adapted to telescope, the oil being thereby forced into and through said tube and thence upon the plunger, where it exerts accumulated pressure. The air which drives the piston during the stroke is utilized to drive it back for another, being finally expelled through the exhaust during the next succeeding stroke. This, as will be apparent, effects an important saving in the volume of air used. The use of the liquid gives a positive and perfectly controlled movement to the punch. The punch is the invention of S. S. Caskey, and is built by F. F. Slocomb & Co., Wilmington, Del. It is made in four sizes, punching up to ¾ inch metal. Special punches are made to order.



A PORTABLE PNEUMATIC PUNCH.

A VARIABLE SPEED GOVERNOR DRIVE.

In our issue of August 2, 1900, we described and copiously illustrated an interesting speed varying device of wide applicability. The accompanying cuts show this arrangement applied to the driving of a steam engine governor. Turning the double-ended handle in Fig. 1 operates the quadrant gears which change the angles of the opposite intermediate friction wheels, and thereby the speed of the driven annular friction plate and of the spindle to which it is keyed is changed. Fig. 2 shows the friction arrangement in section. The driven pulley runs on ball bearings, one of the annular semicircular friction plates being integral with it, and the necessary pressure is supplied by the moving helical spring outside the pulley. This device is made for driving any throttling governor, being easy of application.

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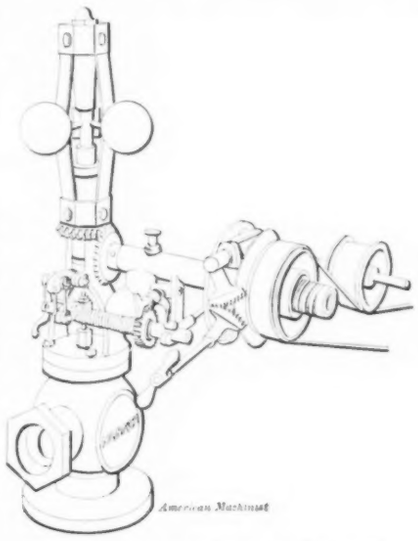

FIG. 1. GOVERNOR WITH VARIABLE DRIVE.

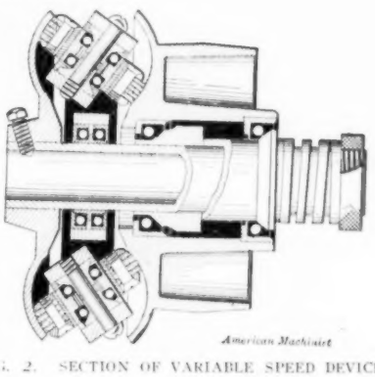

FIG. 2. SECTION OF VARIABLE SPEED DEVICE.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 22.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Wanted—6 ft. or 8 ft. boring mill, in good condition. Materne Mfg. Co., St. Louis, Mo.

Expert work in engineering and mechanical drawing. Address Kacler, care AM. MACH.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas, Bridgeport, Ct. Send for index sheet.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa., build light machinery.

See Presses, Space 45, S. E. cor. Machy. Hall, Buffalo. Ferracute Machine Co., Bridgeton, N. J.

Machinery for tapping cast iron fittings; threads 1¼ to 3 inches. Address "Foundry," AMERICAN MACHINIST.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Partner wanted; one who can bring business for 8 or 10 men and is able to run shop; I have capital and tools. "Partner," Box 196, AMERICAN MACHINIST.

Elegant office and drafting room for rent, in exchange for services teaching mechanical drawing; finest location in New York city. Box 189, AMERICAN MACHINIST.

For Sale—Modern manufacturing plant, equipped with engine, boilers, shafting, electric lights, automatic sprinklers, etc., centrally located; side track on C. & P. R. R. Box 154, Station B, Cleveland, O.

Wanted—For immediate delivery—One new or second-hand gear planer with capacity to dress teeth of water wheel bevel gearing, wood and iron, up to 6 or 7 ft. in diameter. Write, with full particulars, to The Jenckes Machine Co., Sherbrooke, Que.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

A contract in use thirty years; never broken by an apprentice; every machine shop or factory should use it; will send copy for $1; if not satisfactory will return your money. George W. Merrill, 1022 S. Jefferson ave., Saginaw, Mich. Reference, by permission, People's Savings Bank, Saginaw, Mich.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of

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as it is self-contained, requiring only to be slipped on to the spindle and secured by a set-screw or key. The Speed Changing Governor Pulley Company, 740 East Washington street, Indianapolis, are the makers.

Obituary.

Rufus H. Pratt died at Hartford, Conn., June 3, sixty-eight years old. Mr. Pratt was the founder of the Bell Castings Foundry, of Hartford, and of the Pratt & Cady Company, and in recent years he had been connected with the Johns-Pratt Company, all of Hartford.

New Corporations.

Penn Auto Co.; chartered in Pennsylvania; capital, $5,000.

National Vaporizer Co., Kalamazoo, Mich.; capital, $12,500.

Reason Automatic Air Pump Co., Pontiac, Mich.; capital, $12,000.

Farwell Portland Cement Co., Farwell, Mich.; capital, $350,000.

Davidson Heating & Construction Co, Hanover, Pa.; capital, $15,000.

Colonial Steel Co., Moon Township, Beaver County, Pa.; capital, $1,000,000.

Eagle Automatic Machine Co., of Buffalo, N. Y.; capital, $20,000. Directors: James Tate, H. J. Snyder and F. W. Plato, Buffalo.

Reliable Automatic Boiler Feed Co., of New York city; capital, $25,000. Directors: C. C. Cowan, M. B. Whitefield and T. A. Keppler, New York city.

N. Y. Hydraulic & Steam Pump Co., of New York city; capital, $100,000. Directors: George Donger, Frederick Starke and J. F. Jacobs, of Brooklyn.

Oak Motor Co., of New York city; to manufacture electric motors; capital, $2,000. Directors: J. P. Carll, G. B. Ackerly and Jerome Bradley, of Brooklyn.

Iron City Engineering Co.; principal office, New Jersey Corporation Guarantee & Trust Co. Building, Camden, N. J.; object, engineers and electricians; capital, $25,000.

Bridgewater Steel Co.; principal office, 185 Montgomery street, Jersey City, N. J.; object, manufacturing bar and sheet steel; capital, $650,000. Incorporators: J. V. Batton, Ralph McKee, John W. Avery.

Higley Machine Co., of Croton Falls, Westchester County, N. Y.; capital, $25,000. Directors: George Juengst, Jr., and Charles Juengst, of Croton Falls, and L. R. Conkling, of New York city.

Marksboro Portland Cement Co.; principal office, Marksboro, Warren County, N. J.; object, manufacturing Portland cement; capital, $400,000. Incorporators: Andrew C. Snyder, Philip Scanlon and Henry V. H. Snyder.

American Producer Gas Furnace Company; principal office, Salem, N. J.; object, constructing furnaces of all kinds; capital, $100,000. Incorporators: J. Wm. Gaynor, Maurice B. Ayars and Charles A. Ayars.

Motormobile Co.; principal office, the Corporation Trust Co. Building, Jersey City, N. J.; object, manufacturing automobiles; capital, $200,000. Incorporators: John D. Griffen, Joseph C. Pearse, Albert J. Loder.

Reynolds Iron Works Co.; principal office, 185 Montgomery street, Jersey City, N. J.; object, dealing in iron and steel; capital, $75,000. Incorporators: John W. Avery, Horace G. C. Thornton, George R. Allison.

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recommendation or other papers of value should not be inclosed to unknown correspondents.

Situations Wanted.

First-class mechanical draftsman wants a position. Box 178, AMERICAN MACHINIST.

Draftsman, experienced, wants position. E. B., care AMERICAN MACHINIST.

Technical graduate, 30, experienced shop and drafting, wants position. Box 204, A. M.

Situation as foreman, by an experienced foundryman; best references. H. 109, care AMERICAN MACHINIST.

Foreman, general jobbing and repairs, desires change; 10 years foreman; references. Box 206, AMERICAN MACHINIST.

Draftsman and machine designer with shop experience wants position. Address Wm. H. Flood, P. O. Box 313, Scranton, Pa.

Mechanical draftsman wishes position; graduate; 2 years' experience; good references. Box 201, AMERICAN MACHINIST.

Position as foreman machinist, by man, 25 years experience; expert lathe hand; good reference. Box 209, AMERICAN MACHINIST.

First class coremaker desires a position, in charge or otherwise; the last 13 years on heavy machine tools. C. R., care AM. MACH.

A first-class machine blacksmith would like position; 25 years' experience; capable of taking charge; references. Box 205, AM. M.

Wanted—Responsible positions for competent men of mechanical experience. Address James Brady, 220 Broadway, New York.

Experienced draftsman; last 5 years machine tools and fixtures; first-class American and German references. Address Hols. Wiesestr. 1, Berlin.

Wanted—Position as superintendent of machine shop, by man of 12 years' experience as such; 36 years old and with best of references. Box 168, AMERICAN MACHINIST.

Mechanical engineer, a practical mechanic, experienced in organizing and superintending manufactures, is open for position; first-class references. Address Box 123, AM. MACH.

Mechanical engineer, practical, competent, wants to change; specialties, printing machinery, hydraulic machinery and gas and gasoline engines. Address Box 159, AM. M.

An assistant superintendent, age 35, specialty automatic machinery, and producing fine material in large quantities, solicits correspondence. Box 192, AMER. MACHINIST.

Wanted—Position as general foreman; a thoroughly experienced gas engine and automobile man, familiar with French, German and English motors. Box 203, AMER. MACH.

Mechanical engineer, technical graduate, 15 years a practical machinist, progressive, energetic, desires position as foreman or general foreman. Address "Brooklyn," care A. M.

Position as superintendent; capable of handling men to a good advantage and reducing costs by labor-saving devices; will purchase interest in a reliable concern. Box 177, AMERICAN MACHINIST.

Technical graduate, 29, with 7 years' practical experience, mill machinery, tools, fixtures, open July 1 for position as master mechanic or chief draftsman; best references. Box 170, AMERICAN MACHINIST.

An American, 37 years old, thorough mechanic, familiar with cost system, either piece or day's work, has handled 400 men, good disciplinarian, desires position with good house. Box 190, AMERICAN MACHINIST.

Superintendent.—Up-to-date young man, 10 years' experience as superintendent of brass work of every description, desires to make a change and locate with up-to-date house. Address "Brass," care AMERICAN MACHINIST.

Situation as superintendent or mechanical engineer by Stevens graduate, age 37; specialties, gasoline automobile engines, design of tools for manufacture of cash registers, typewriters, etc. Address Box 208, AM. M.

Mechanical foreman of inventive ability desires a position in a firm of boiler makers; is familiar with the most modern methods of manufacturing boiler parts and fittings; skilled in tool and die work. Address Box 191, AMERICAN MACHINIST.

Wanted—Position as foreman of machine shop, by a man, 35 years old, with 10 years' experience as foreman on Corliss engines, pump, sugar-house and hydraulic work; first-class reference; reason for changing. Address Box 202, AMERICAN MACHINIST.

Fifteen years' experience, apprentice to superintendent in various works, tools, typesetters, cash registers, gas engines, automobiles, etc.; successful manager, resourceful designer, solicits correspondence with those needing capable, trustworthy assistant; A1 references. Box 198, AMERICAN MACHINIST.

Superintendent of unquestionable executive ability and broad experience, thorough mechanic, both practical and theoretical, familiar with up-to-date cost-keeping systems and shop management, at present in charge of large concern, American, age 36, will be open for engagement July 1. Address Box 175, AMERICAN MACHINIST.

Help Wanted.

Wanted—Good machinists at Detroit, Mich. Address Box 195, AMERICAN MACHINIST.

Wanted—Two first-class operators on Gisholt turret lathe. Box 185, AMER. MACH.

Wanted—Non-union machinists; first-class all-around men on general work. Address B., care AMERICAN MACHINIST.

Wanted—An experienced machinist who can file punches and dies for steel or brass. Oneida Community, Ltd., Sherrill, N. Y.

Wanted—First-class toolmaker on iron body gate and globe valves; liberal wages; give experience and age. Box 200, AM. M.

Practical machinist who has had experience as foreman, to take charge of a small hardware specialty and implement business. P. O. Box 871, Orange, N. J.

Wanted—A first-class superintendent of production, by high-speed engine manufactur-

Draftsmen Wanted.

We have positions open for capable, experienced Mechanical Draftsmen. Our business is to assist Draftsmen and Engineers (technical men only) to secure positions when unemployed, and to better their positions when employed. Our business was established in 1893.

No registration fee.

THE ENGINEERING AGENCY,
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OHIO STATE UNIVERSITY, COLUMBUS, College of Engineering. Nine four year courses leading to Engineering degrees. Three short courses. Total expense, including all fees, board, room and books, may be under $200.00. Many students are self-supporting. Credit given for shop and drawing room experience. Catalog on application to executive office.

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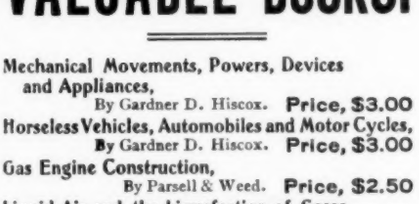
W. R. SAWYER, Lessee.
86 SENECA STREET,
CLEVELAND, O.



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By Prof. T. O'Conor Sloane. **Price, $2.50**

Gas, Gasoline and Oil Engines,
By Gardner D. Hiscox. **Price, $2.50**

Complete Electrical Library (5 volumes),
By Prof. T. O'Conor Sloane. **Price, $5.00**

Linear Perspective Self-Taught,
By H. T. C. Kraus, C. E. **Price, $2.50**

Inventor's Manual, How to Make a Patent Pay,
New, revised and enlarged edition. **Price, $1.00**

Saw Filing and Management of Saws,
By Robt. Grimshaw. **Price, $1.00**

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